ERADICATION OF GUINEA WORM DISEASE

HEARING

BEFORE THE

INTERNATIONAL TASK FORCE

OF THE

SELECT COMMITTEE ON HUNGER
HOUSE OF REPRESENTATIVES

ONE HUNDREDTH CONGRESS

FIRST SESSION

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ERADICATION OF GUINEA WORM DISEASE

TUESDAY, MARCH 17, 1987

HOUSE OF REPRESENTATIVES,
INTERNATIONAL TASK FORCE,
SELECT COMMITTEE ON HUNGER,
Washington, DC.

The task force met, pursuant to notice, at 9:35 a.m., in room B-352, Rayburn House Office Building, Hon. Tony P. Hall (chairman of the task force) presiding.

Members present: Representatives Flake, Bilbray, Bereuter, and Gilman.

OPENING STATEMENT OF HON. TONY P. HALL, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF OHIO

Mr. HALL. I think what we'll do is get started instead of waiting for the members. I think they will be filing in and out all morning.

Thank you very much for coming. We look forward to your testimony and we are very pleased to have you with us today.

Since it was created the select committee has supported funding for water and sanitation projects as a component of the U.S. Government's foreign aid program. Considerable progress has been made in providing safe sources of drinking water and sanitation for populations residing in urban areas. But the majority of rural residents in developing countries are still without safe drinking water.

For example, in Africa less than one-third of the rural population has access to safe drinking water, and only about 20 percent have access to adequate sanitation. In some countries such as Guinea and Uganda less than one-tenth of the rural populations have access to safe water. In India about one-half the rural population has access, but in Pakistan only about one-fourth of the rural population has access.

Guinea worm disease is a dramatic consequence of the lack of access to safe drinking water. Guinea worm disease is a horrendous water-borne parasitic disease which affects about 10 million persons each year. It is the only communicable disease spread only by contaminated drinking water. Therefore, it can be completely prevented by providing access to safe sources of drinking water.

Guinea worm disease severely retards economic development through negative impacts on food availability, health, agricultural production, and school attendance. Estimates of the size and value of these losses vary. But a 1982 World Bank estimate places the figure at more than $1 billion per year.

The Select Committee on Hunger recognizes the important benefits that would result from eradication of Guinea worm disease,

and believes that the U.S. Government and the Agency for International Development are in a position to play a leadership role.

Of the villages in the developing world without safe drinking water, only 5 to 10 percent are estimated to be afflicted with Guinea worm disease. Therefore, targeting resources and efforts toward these villages would rid the world of this disease.

Today we have a panel of experts to tell us more about the extent of Guinea worm disease.

The first witness is Dr. Peter Bourne. He is a gentleman who has a longstanding involvement with programs designed to increase access to safe drinking water for people in developing countries.

Following Dr. Bourne's testimony we'll hear from Dr. A.O. Lucas. Dr. Lucas' testimony will draw on his personal experiences as a physician and medical researcher on Guinea worm disease in his native country of Nigeria.

Our third panelist will be Dr. William Foege, who is the executive director of the Carter Presidential Center of Emory University. Dr. Foege will present testimony which President Jimmy Carter prepared for this hearing.

The final member of the panel to speak to us will be Dr. Donald Hopkins. Dr. Hopkins is Deputy Director of the Centers for Disease Control and Director of WHO Collaborating Center for Research, Training and Control of dracunculiasis.

Dr. Hopkins has graciously agreed to attend the hearing to provide information on a subject in which he is expert. His statements are not meant to represent the Centers for Disease Control on policy matters.

Gentlemen, we look forward to your comments.

Congressman, do you have any comments?

Mr. BILBRAY. No comments.

Mr. HALL. We certainly look forward to what you have to say. We'll start with you, Dr. Bourne.

STATEMENT OF PETER G. BOURNE, M.D., PRESIDENT, GLOBAL WATER, INC., AND PRESIDENT, AMERICAN ASSOCIATION FOR WORLD HEALTH

Dr. BOURNE. Thank you, Mr. Chairman. It is a real pleasure to be here this morning, and I would particularly like to thank the committee for holding this hearing on this really very important subject.

As introduced, I am Peter Bourne. I'm the president of Global Water, a nonprofit organization concerned with water problems in the Third World. I'm also the current president of the American Association for World Health, which is also vitally interested in this Guinea worm disease issue.

Previously I served as Assistant Secretary General with the United Nations, and in that capacity I set up and coordinated the International Drinking Water Supply and Sanitation Decade, a program aimed at providing clean drinking water for people throughout the world.

I think it's hard perhaps to overstate the importance of water in the lives of people living in the Third World, particularly those who live in the rural areas. For those of us who always have lived

where unlimited supplies of clean water was only as far away as the nearest tap, I think it's difficult to appreciate how water, or the absence of it, totally dominates the lives of people who live in most countries of the Third World.

I believe that probably without question, making water available to people is the single most important aspect of development in the Third World. Of the 12 to 15 million children under the age of 5 who die in the Third World each year, the majority die directly or indirectly because of lack of access to clean water. One-half of all the hospital beds in the world are occupied by people with water-related diseases.

In much of the developing world, women and children walk miles every day just to get a gallon or two of water for their family's survival. Any sort of economic productivity, even the simplest kind of handicrafts like weaving and dying, require a steady supply of water. Without it, it is almost impossible for people to get into the cash economy.

I don't need to talk about the obvious relationship between water and irrigation and other agricultural activities before this community because that is familiar to all of us.

It is because of these reasons and the extraordinary importance of water that in the midseventies a group of experts, leaders, concerned about Third World development decided that we could no longer morally tolerate in the world a situation where one-half of the world's population didn't have access to clean water. Nor could we ignore the fact that providing clean water was probably one of the most cost effective, long-lasting, and profound ways of changing the quality of life for people in the Third World.

As a result, the United Nations created the U.N. International Drinking Water Supply and Sanitation Decade. It had as its objective providing clean drinking water for everybody. Obviously that was a rather ambitious goal in 10 years, but I think it was intended to be more than anything a rallying point without any real expectation that we would 100 percent achieve that goal.

Early in the existence of the decade, Dr. Donald Hopkins brought to my attention and others leading the program the fact that, as a result of the decade we have an extraordinary opportunity to eradicate worldwide one disease, as you mentioned, Mr. Chairman, dracunculiosis or Guinea worm disease. It is the only disease exclusively transmitted by drinking water and in no other way.

As a result of this concern and awareness, the United Nations steering committee that was responsible for coordinating all of the U.N. activities in this area in April 1981, adopted the global eradication of Guinea worm as a subgoal of overall decade program.

I will leave it to my colleagues to go into the details of the disease and what has been done in that eradication effort since that time. I would like, however, to make two specific observations.

First, while all water-borne diseases obviously contribute to malnutrition and reduce peoples' productivity, the correlation between the presence of Guinea worm in a community and the decline in food production is particularly dramatic and well documented. You cited the figures from the World Bank. Those sorts of figures have been shown by study after study.

I think it's fair to say that in a broad swath across the middle of Africa, through much of Pakistan, and part of India people are prevented from feeding themselves exclusively because of the presence of this one preventable disease. And if we were able to eradicate it, literally millions of people would become food self-sufficient.

Second, not only is Guinea worm relatively easy to get rid of in an individual community, but we really do have it within our grasp to eradicate this disease like small pox from the world once and for all and never have to worry about it again.

What is crucial about this moment in history is that because of the water decade we have the attention of the governments of the Third World focused on water problems and the problems of their people that relate to the lack of water. The eradication of Guinea worm can easily and successfully be piggy-backed on that interest.

Unlike probably most groups that come before this committee we are not asking for a vast new program or vast appropriations of money. What we are looking for is that there be a commitment on the part of the U.S. Government, particularly by AID, to recognize the potential for the eradication of this disease and to take a visible public position to support the eradication effort.

We feel that this can be done within the existing framework of AID's commitment to rural water supply. We do feel, however, that there should be some specific administrative focus within the Agency to monitor the eradication effort and to support the campaign with perhaps a modest budget, $2 to $3 million, to provide technical expertise to those countries that need it in launching their own programs to get rid of Guinea worm.

More broadly I feel that AID could do more in the water area and the provision of rural water supply. I have covered this issue in my submitted testimony and I won't go into it in further detail here.

Mr. Chairman, let me just in conclusion say again that I really appreciate the holding of this hearing today. I feel that although to many people Guinea worm may seem like an esoteric disease and an esoteric topic, it devastates the lives of literally millions of people. The fact that none of them are here in the United States makes it no less of a concern for us if we really want to concern ourselves with a global responsibility.

I think we have at relatively low cost, an opportunity to get rid of the disease, and I think it's an opportunity we can't afford to pass up.

Thank you.

[The prepared statement of Dr. Bourne appears at the conclusion of the hearing, see p. 32.]

Mr. HALL. Thank you, Doctor. I look forward to questions later on.

Dr. Lucas.

STATEMENT OF ADETOKUNBO O. LUCAS, M.D., CHAIRMAN, CARNEGIE FOUNDATION PROGRAM OF HUMAN RESOURCES IN DEVELOPING COUNTRIES

Dr. LUCAS. Thank you very much, Mr. Chairman.

Ladies and gentlemen, I am very happy to be given this opportunity to speak. I've been called to testify and I regard myself much more than an eyewitness to tell you what I've seen of Guinea worms in my own personal experiences in Nigeria. I'll give the technical details about the parasites life cycle, and so on, to the other experts who are present.

I worked in the University of Ibadan Medical School in Nigeria for about 16 years with colleagues looking at many health problems, but we had a particular interest in Guinea worms.

During that period three main areas were of interest to us. One was to look at the social and economic impact of the disease on the communities; two, we did some studies on the drug treatment of infected persons; and, third, we were involved in some testing of water supply as a means of controlling the disease.

On the social and economic impact I have here in some detail my first encounter with Guinea worm. I have gone into detail about it because all those who have seen an epidemic of Guinea worm in a community know that it's an event that you'll never forget. We came across it just purely by accident. We were going around rural areas, around Ibadan city, looking at the health of children of school age. We got into this community and many of the children were not at school but one-third of them were absent. Those who were present, also about one-third, were affected by Guinea worm.

So we went to the villages to see what was going on, and I saw a picture which had an indelible effect on my memory. More than one-half of the people were sick with Guinea worm, and the sick were attending the sick. Most of the farmers could not go to the farms. Those who were able bodied had to look after those who were infected.

It was not the severity of it in each individual although there were some very spectacular manifestations of the disease. But it was the total picture of the community that was really brought down onto its knees by this disease that was very impressive.

It was not like an epidemic of influenza where people would recover after 2 or 3 weeks. The tendency was for this disease to hold the community down for 2 or 3 months because we don't really have any satisfactory treatment for the sick patients.

So my colleagues and I have looked at the community impact of the disease.

Professor Kale who succeeded me in the chair, estimated that infected persons are disabled up to 100 days in the year when they were infected. Dr. Ilegbodu and his colleagues found that the absentee rate among school children was only 2.5 percent in the villages that did not have Guinea worm, but was as high as 21 percent in the villages that have Guinea worm. So this disease undermined the efforts of development in the rural areas.

So what I saw of Guinea worm was a disease that cripples the whole community not just physically, but in terms of their social and economic activities.

Briefly, to draw attention to the frustration of chemotherapy—we tried different drugs, and at the end of it we found two drugs which could relieve the symptoms, I think we can summarize the situation today by saying that there is really no useful chemotherapy for the disease.

I do not think that it should be a priority to develop a new drug against Guinea worm for its treatment because we were all delighted to see how relatively easy it was, once we could get the water supply to the people in a safe way, to get rid of Guinea worm from these villages.

One of the effects of this introduction of water supply we found was that it made the community more ready to listen to us in the development of new health programs. Once we could show them that we had some ideas that were better than the traditional ideas that they had in the community for preventing disease, then they would listen to issues about immunization, about family planning, and so on. So quite often we tried to use the control of Guinea worm as the first thing to make ourselves good friends of the community and to make them listen to us in other health programs.

Finally, as I mentioned, I'm here just giving an eyewitness account. I'm not representative of the Nigerian government. But I'm very pleased to see that the government in Nigeria has taken seriously the issue of dracunculiasis and they have, in fact, set up a program which is aimed at controlling and finally eradicating the disease from Nigeria, the largest country in Africa.

We do in fact have a massive problem with Guinea worm. Several centers in Nigeria have doctors and other scientists who are familiar with the problem of dracunculiasis. It is hoped that using their expertise with the support from UNICEF, U.S. AID and other agencies, that something can really be done to get rid of Guinea worm from Nigeria, as in other African countries.

Thank you very much.

[The prepared statement of Dr. Lucas appears at the conclusion of the hearing, see p. 41.]

Mr. HALL. Thank you, Dr. Lucas. Our next witness is Dr. Foege.

STATEMENT OF WILLIAM FOEGE, M.D., EXECUTIVE DIRECTOR, CARTER CENTER, EMORY UNIVERSITY

Dr. FOEGE. Thank you, Mr. Chairman.

You have the statement of President Carter. The statement brings out his concerns and interest in this problem and his desire as a farmer to do something about it. But it goes beyond interest and concern. The statement also indicates that he is doing something concrete with a foundation called Global 2000, working in two countries at the moment; Pakistan and Ghana.

I would like to emphasize three aspects of his statement. But first let me say that my interest in Guinea worm started over 20 years ago when I was in charge of a medical center in Nigeria and found the same thing that Dr. Lucas has just mentioned; that in some villages one-third to one-half of the population would be incapacitated at one time. It has always, in that area of Nigeria, turned out to be during the planting season.

In addition to that, the age groups most severely affected were from age 15 to 45; a group that would be needed for planting. It's true that some people recovered within a month or so, but 40 percent of the people were incapacitated for as long as 6 weeks or longer. And while this is a long time for anyone, it's a very long time for farmers to be incapacitated during the planting season.

Because Guinea worm appears not to provide immunity, the same people could be infected year after year so this was an ongoing problem in certain areas.

The second area I'd like to mention is that the experience in Pakistan since President Carter was there last November has been very heartening. They are giving special attention to two geographic areas to see if they can concentrate on reducing transmission during the next transmission season.

The epidemic season for Guinea worm in Pakistan is between April and about August or September. In those two areas what they are trying to do is to make sure that transmission does not take place between April and September. They will still have the cases because people are now incubating the worm and it will appear this summer. Those cases will still occur, but they are trying to put into place something to stop transmission from those cases to others.

They're using safe water supplies where this is practical. Where it is not practical they are trying to use chemical treatment of the water reservoirs. In all cases they're trying to educate people to boil water or to filter their water, and they're also trying to put bandages on the Guinea worm lesion itself. It doesn't do anything for the treatment of Guinea worm, but people are less likely to step into stepwells if they have a bandage on their foot.

The capacity in Pakistan is developing very quickly and the country interest is obvious. In addition, this June, during the height of the transmission season, they will have a countrywide search looking for Guinea worm. This will be very similar to the old smallpox searches of a dozen years ago, where during a short period of time, probably a 6- to 8-day period of time, every village in Pakistan will be visited to see whether or not they have Guinea worm. It should be possible then to delineate which areas have Guinea worm, and over the following year concentrate resources in those areas rather than wasting any resources on areas that do not have Guinea worm.

Pakistan is serious about the goal of Guinea worm eradication by 1990. It's a very ambitious goal and we really won't know until this summer's search, how realistic that is. But I can tell you that they are serious about it.

One of the major reasons for needing a search such as this is that countries simply don't know how big the problem is. In President Carter's testimony he indicates visiting one place in Pakistan last November where two cases of Guinea worm had been reported last year, but 1,200 cases had actually been seen by one person in that area. So the problem is always vastly larger than the statistics would indicate, and the reason is that Guinea worm occurs in rural areas, remote areas, areas that are not usually seen by ministry of health personnel or by politicians.

In most places it's not been a reportable disease and oftentimes there's been a gap between cases and the medical system. People don't go to the clinics or hospitals if they know that there's no treatment that they can get.

So for all of these reasons, every country starts with the disadvantage of not truly knowing how large the problem is.

We are also starting a program in Ghana. Two people have recently been there, and Ghana is interested in starting a nationwide Guinea worm eradication program.

The third and last point is, why should we do this given the large problems of cancer, heart disease, malaria, and so forth? I think you can see from the papers that have been submitted that this problem really is much larger than people think. Something over 100 million people are exposed to this, and someplace between 5 and 15 million each year actually get the disease. It's a large problem from the morbidity point of view. It's a small problem from the mortality point of view. But from the agricultural, economic point of view it's large.

And, I can tell you, it's just plain an ugly disease. It's a disease of suffering.

The health problems of this world are all related. And while we have known that malnutrition causes infectious diseases to be worse, we now see that this really is one large mass; that infectious diseases also make malnutrition worse, and with Guinea worm we see not only does it make malnutrition worse, but it also decreases agricultural productivity.

There's a debate going on today whether it's worth attacking single problems such as this, and whether this does not simply result in mortality rates and morbidity rates going up for other reasons, with the net effect being zero.

This same debate was going on in the United States 100 years ago. It's been clear in retrospect that in fact it did pay to attack one problem after another. And where we are in health today is the sum total of attacking each problem.

Over 2,000 years ago the historian Polybius made the point that it may have been possible in the past for things to happen in the world that didn't relate to each other. But, he says, from this time forth—and he says this 2,000 years ago—from this time forth the world must be seen as an organic whole where everything effects everything.

The same is true with Guinea worm. This is part of that organic whole, but it is something that we could be correcting. And instead of mortgaging the future of our children as we do in so many other ways, here is an opportunity where at low cost we can correct the current problem and, as with smallpox, remove it from the future agenda of our children.

I think in closing I'd like to say one good test of civilization is how we treat future generations in developing areas of the world. And for that reason our thanks for highlighting this opportunity.

Thank you.

[The statement of President Jimmy Carter appears at the conclusion of the hearing, see p. 46.]

Mr. HALL. Thank you, Dr. Foege. Dr. Hopkins, you're the last witness we have as far as this panel is concerned.

I understand, you want to show some slides to us.

Dr. HOPKINS. Yes, I do.

Mr. HALL. Do you want to show them now?

Dr. HOPKINS. Yes. We can take care of the slides and get those out of the way.

Mr. HALL. All right.

STATEMENT OF DONALD R. HOPKINS, M.D., DEPUTY DIRECTOR, CENTERS FOR DISEASE CONTROL, PUBLIC HEALTH SERVICE, U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Dr. HOPKINS. I want to thank you and the other members of the committee as well for, first of all, holding this hearing to help highlight what is not just an awful, but a very serious problem.

This worm manifests very dramatically by the adult worm, each one measuring 2 to 3 feet long, emerging from any part of the body. While the overwhelming majority of these worms tend to emerge from the foot, ankle, or lower leg, they can, as you will see, emerge from any part of the body.

In the interest of not running people out of the room, I'm not going to show the worst slides that I have of this disease, but only some to illustrate the power and, more importantly, its impact on people beyond that horror.

In this slide you'll see the traditional method of treatment being used; wrapping the worm around a match stick or a small twig. You can also see the ulcer which is created by the worm as she is about to emerge. And on this particular person you can see other scars, similar scars, which almost certainly represent previous Guinea worms having emerged from this person.

As you've heard, there is no immunity to this infection. So people who are so unfortunate as to drink water contaminated with the larvae can be and are infected year after year after year. While most patients wind up with only one or two worms emerging from some part of their body, the especially unfortunate ones can have more than a dozen worms emerging at the same time.

The worms seem to emerge from the lower leg or foot. They can emerge from any part of the body. You can sense here an abcess around the ulcer through which this worm is being slowly extracted. You can't just pull these things out, and that's why they're slowly wrapped around a stick. If the worm breaks, it exacerbates the inflammation and severity of the reaction around it. Sometimes adjacent joints are also involved.

This is the worm which has chosen to emerge from a woman's hip. It's obvious enough. Here's one from a man's chest. This worm has a string tied around it.

Now, apart from the horror of living worms coming out of one's body, you can imagine trying to hold a hoe or some other farming implement with a hand, which is as painful as this hand must be. Similarly, imagine trying to walk out or do work on a farm with a foot like that.

This man is crippled because of secondary infection. You get an idea of the quality of the drinking water in the bucket there. Here's another man crippled from the disease.

As Dr. Lucas has pointed out and Dr. Foege, you cannot go into these villages and not be moved by otherwise able bodied people sitting around, lying around, because of this infection. What does not come through from these slides is the pain and the duration of it.

Finally this is a village in Burkina Faso with a typical source of drinking water there. The man with the blue cloth slung over his

shoulder, his right foot is dark because he has a blister on it, with a worm about to emerge.

The temephos chemical treatment which has been spoken of, the amount of temephos in this bottle, which has only about an ounce or so of temephos in it, would be enough—this costs about 50 cents U.S.—would be enough to treat that body of water twice, approximately, at 4- to 6-week intervals to prevent the infection in that village.

These are the geographic areas of the world where disease occurs. You can note that the band across Africa is coincident with the band of countries effected most by the recent drought and famine. It's not by accident. Both conditions relate to scarcity of water.

The other thing about this slide is that it illustrates, reminds us of the power of the media in all of this, as does the final series of slides that I want to show.

At the University of Ilorin, Nigeria, a researcher gave an interview to a reporter. This appeared on June 10, 1984, this headline, as did the next one, "Kankan, The City of Guinea Worm." This disease does not stand the light of the media very well.

Within 1 week of that previous headline, was this headline because the local ministry of health and UNICEF decided to change their priorities. About one-third of the villagers in this village had Guinea worm. This occurred in June. The next day there was this headline.

Dr. Lucas has told you the treatment doesn't cure people. But that's the end of this series of slides. All of that happened in June 1984, which was before the regular transmission season. The village was provided with safe drinking water.

I'm happy to report that in the subsequent transmission seasons, 1 year ago and as of last month, this current transmission season, there had been no more Guinea worm in Kankan because they had been provided with safe drinking water.

The disease is important because it incapacitates people. Apart from its horror it incapacitates many people for long periods of time at a crucial period in the agricultural year. It has impact on agriculture, on health, and on education.

I want to correct one small item in my testimony as submitted. I refer there to a positive cost benefit ratio. That should be positive benefit cost ratio because the various interventions which I mention there are quite efficient in getting rid of this infection, and there is a return over and above the investment in benefits.

The second point, apart from the fact that this is a serious disease, is that it can be eradicated. There should be no more doubt about this. I remember very vividly hearing a person in a certain Asian country, who was in fact a senior member of the smallpox eradication program in that country, telling me less than 2 years before smallpox was eradicated in India that it would not be eradicated from India. We know this disease can be eradicated. It has already been eradicated from the southern Soviet Union, from Iran, from Tamil Nadee, a state in India. And there should be no more doubt about the eradicability of this disease.

There's no animal reservoir, there's no place for it to come back from except from other people.

My third point is that this disease should be eradicated. Some people have said that this is not an important disease. As Dr. Foege and Dr. Lucas has pointed out, that is a misperception. I think the first question I like to ask in response to that is, Not important to whom? Again, one cannot go into these villages and not be impressed with what this disease means to people who are so unfortunate as to have to drink the kind of water that we've seen.

The reasons why it should be eradicated, apart from humanitarian reasons, are that eradication is permanent, and once it has been eradicated the disease cannot come back even in the face of a natural or a manmade disaster, such as the population movements we're seeing in some places of Africa now in response to drought, famine, or civil conflict.

Eradicating it means that the various control measures don't have to be funded indefinitely.

Second, clearly it needs at least to be controlled. The nature of this disease is such that what it would take to control it is very close to what it would take to eradicate it. I think one needs to just from the beginning admit that one is going for the whole ball of wax to get rid of the disease entirely.

Eradicating it allows, permits greater mobilization, enthusiasm for a shorter term than an indefinite control program. I think eradication is important for that reason.

And, finally, we have the resolution from the World Health Assembly, which is the only such resolution since the smallpox eradication program. We have this special opportunity of the water and sanitation decade, of which we have still remaining 3½ years, and this is an opportunity for this generation to eliminate this disease.

It makes no more sense to say that we should not focus on a single disease here as it did in the case of smallpox. One might have said well, we can increase general immunization levels around the world, but if we had taken that approach to smallpox we would still have smallpox.

Finally, in terms of what in my view is needed, I think you have gone a very long step in holding these hearings and announcing these hearings in helping to hold this disease up to the scrutiny of the public.

We are working at the collaborating center at CDC to pursue the objective of trying to ensure that all of the major endemic countries have plans to deal with this disease by the end of this calendar year. There's a special urgency because of the water and sanitation decade, which is shortly about to end.

I think if we can do nothing else, if we can get those countries, the major bilateral agencies, the United Nations agencies concerned, and the various private and voluntary groups, who already have water supply, health, education, and other kinds of primary health care projects in areas where this disease is endemic, if they would only in every such instance take cognizance of this disease and include a so-called Guinea worm component in their programs, that in itself would go a long way toward eliminating this disease. It would also give those agencies a very visible important benefit to point to as a result of their efforts.

I want to end as I began, again by congratulating and thanking this committee for helping to hold this terrible disease up to the public light.

Thank you.

[The prepared statement of Dr. Hopkins appears at the conclusion of the hearing, see p. 49.]

Mr. HALL. Thank you, Dr. Hopkins. Thanks to all of you for making us more knowledgeable about what looks to be a horrendous disease to have.

I've seen the sores and swelling caused by the disease in various countries, but I've never really understood the disease. It's been around, as I understand, for 3,000 to 4,000 years. Considering some of the things that we considered in our last hearing I believe we have here another situation where education is important. People who are working and living in rural areas need to be instructed to avoid contaminated drinking water. They also need to be taught how to develop clean water supplies.

Dr. Hopkins.

Dr. HOPKINS. If I may just respond, Mr. Chairman, I think you're right. Obviously people have to have water from somewhere. And if one lives in a village like this, say a trade off between how far one might have to walk to get to a flowing stream, if it's within a reasonable distance at all. Nobody clearly wants to have this disease.

I would say that one of the things that can be done and needs to be done is to help people to understand first of all where it comes from. There are also some myths about where it comes from. But understand that it comes from the drinking water, and then understand further that they can prevent themselves from catching it.

If they only have sources of drinking water such as we've seen, at least in the interim they can boil their water. But that is often difficult because fuel is too expensive or scarce or filter it through a double thickness cotton cloth to eliminate the intermediate vector which carries this worm.

Mr. HALL. I'd like to first start off with a question to each one of you and then turn it over to the other members for questions that they might want to pose to you. I'd like to start off with Dr. Bourne.

As I look at your testimony, Dr. Bourne, and I'm reading from page 5, it says, "Despite its supposed commitment to the decade, AID has turned its back on the rural population, the primary target for this program. Where rural projects have been funded the leadership has almost invariably come from the field not from Washington."

That is a very discouraging—it's a harsh statement and a very, very discouraging statement.

Do you think that statement is a fair one? Why do you think that leadership for funding rural projects has not come from Washington?

Dr. BOURNE. Well, let me say, Mr. Chairman, I think this is true not just of AID. It was true, the same criticism could be made, of the United Nations. When the water decade was created, the people who were most skeptical about it were the people in the U.N. headquarters in New York. The further you got away from New York, the more enthusiasm there was for the decade.

The country directors were wildly enthusiastic about it. When you got beyond the capitals and went to the village, people said water is our No. 1 issue. Whereas, if you talked to the people at the U.N. headquarters they'd say, Is water really that important, do we really need a decade?

I think this is one of the problems that we face at the present time in our own Government. It is the same situation that the mission directors, the people out in the field, are much more enthusiastic about rural water supply because they see the issue every day, they see Guinea worm, they see other problems, and they know that this is what needs to be done.

The mission directors are asking AID here in Washington to support rural water programs when very often the sympathy is not present to be as responsive as it should be.

If you just look at the figures in terms of the amount of money that has been put into rural water programs since the decade began, not only has it gone down in absolute terms, it has gone down extremely dramatically in terms of the ratio of money going into urban water projects versus rural water projects.

Now, people living in cities need water, too, but I think the kind of expenditure that we have seen, for instance, for the massive water and sanitation program in Egypt compared to the kind of impact that amount of money would have had in the rural areas of Africa, is not the right priority for us in terms of where money should be going to alleviate human suffering.

Now, obviously other factors, other considerations were taken into account in terms of those sorts of decisions, but I think there has been an abandonment in recent years of the traditional commitment to the poorest of the poor, particularly the people living in the rural areas. And those are the people for whom the suffering is greatest and for whom this water decade was primarily constructed.

Mr. HALL. We have heard from U.S. AID that water projects are not cost-effective.

What's your opinion of this statement?

Dr. BOURNE. Well, I disagree. I mean, I think it's a question of how you judge it. I think it's the same kind of question that Dr. Hopkins was asking. If people say this is not an important disease, it's a question of important to who.

We put a great deal of effort into providing clean drinking water in this country 50 years ago, and it dramatically changed the mortaility rates in this Nation. To argue that it was justifiable here, but it's not cost effective in the Third World seems to me to make no sense at all.

I think part of the difficulty is the impact is more long-term than perhaps we tend to want at the present time. We tend to look for programs that have very short-term dramatic impact where you can see a measurable change within a matter of months. Very often it takes 2 or 3 years after you put clean water supply into a village for the infant mortality rate to go down because you have to change people's behavior patterns as far as water is concerned, get them to start using water in the quantities that will really effect their health, to wash themselves, wash their children, a

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whole variety of things have to change besides just the mechanics of putting in the water.

I think if you look at these issues on a long-term basis you will see that it is perhaps one of the most cost effective interventions.

Mr. HALL. Thank you, Dr. Bourne. Dr. Lucas, we know so very little about Guinea worm disease here in the United States. Tremendous numbers of people could be affected by it; 10 million people are affected by it. Can you estimate for us what it would mean if this particular worm could be eradicated from, let's say, your country of Nigeria?

Dr. LUCAS. I think that we mustn't make exaggerations. There will be plenty of health problems remaining in Nigeria after Guinea worm has been eradicated. But in those areas that are affected, those populations that are constantly being visited year after year by Guinea worm, it would make an enormous difference.

The 2.5 million cases that have been estimated each year means that populations up to 10 million or so are in fact being damaged by it because for each person who is sick, a whole family may suffer.

I feel that the impact of a controlled program would be, first of all, it would move out of those communities something which is dangling over them as sort of a—they'll be able to get on with their planned development, agriculture, schooling, and so on.

I know of no other major epidemic in Nigeria which effects communities in such a dramatic fashion as Guinea worm does.

The second point which I made in my paper I raised this, that the introduction of water would have this immediate dramatic effect a year or two of no more Guinea worm. But I think that the long-term benefits on infant mortality rate, diarrhea diseases, and so on, would in fact be very, very important.

So that even if people are not so directly involved with Guinea worm as a concept, the advantage of introducing safe water would go beyond Guinea worm for other benefits.

Mr. HALL. As the larva is drunk in the water, it comes into the body. It's in the body for a year approximately, as I understand it, before it starts to make its way out of the body.

When does the swelling start, and when does the disease incapacitate? When does it really get to be very difficult?

Dr. LUCAS. The thing that is swallowed, it's the cyclops, the water flea. It's just about visible. If you have it in a glass of water and you look through it, you'll see it like a speck of dust. So it's not a big thing, it's a tiny thing.

And inside that water flea are these small larvae that then hatch out, go through the intestine, and move around the human body. This type of thing is one of the great miracles in biology because somewhere in the wide expanse of the human body, those tiny larvae have to mature, the male worms have to find the female worms inside a human body. They mate, as far as we know, the male dies. It is the female worm that then spends the remaining 12 months or so growing to that long worm.

It seeks out some surface of the body, usually in the legs, and it comes under the skin. At that point some irritant fluid comes out of it which causes the skin to blister. The head of the worm then protrudes out of that hole.

Then a curious thing happens. The female worm then literally loses its head. The top portion of the head of the worm comes out. That worm we see is just a tube of larva. Each time the person bathes his leg in cold water, the worm contracts and throws out larvae.

The female worm does not survive. It ends its life in that one life cycle. So this is why there's this 1-year cycle with it. People bathe their legs in the dirty water, the larvae go in, enter into water fleas, people drink it, and then a year later new worms come out.

Not all the worms that are developed actually reach the surface. Some get lodged in various organs. But most of the difficulty comes up when this worm comes onto the surface of the skin. And, as Dr. Hopkins said, one or two is the usual number. But I've seen patients with many worms, for example, a woman who had 14 different worms: both legs, both arms, her abdomen, her genitals were all involved with worms coming out all over the place.

Mr. HALL. In an effort to relieve some of the swelling and the tremendous pain that comes, victims seek cool water. Then the larva drops off and starts the whole process all over again. The water gets infected, somebody drinks it, and it starts all over.

Dr. LUCAS. Yes, that's the way the cycle is. Actually, when we want to obtain larvae to study, we pour cold water onto the worm and it contracts and shoots out more of these larvae into the fluid.

It seems dedicated, a whole lifetime dedicated to its own reproduction. The adult worm doesn't have any other life. The adult male has never been seen in man as far as I know. It's been seen in animal experiments where we've tried to find out just how it develops. The male drops out of the picture very early in the game and it's this adult female worm that grows to that enormous length, about 2 to 3 feet, comes out through the skin. And by the time it protrudes, it already is virtually dead. But it can then go onto the next generation by putting out these thousands and thousands of larvae which then get swallowed by somebody else.

Mr. HALL. Thank you, Dr. Lucas.

Dr. Foege, as you travel around the world and you discuss this campaign with various health experts, are you detecting a commitment from health professionals all over the world to eradicate this?

Dr. FOEGE. Very much so, Mr. Chairman. Unlike smallpox, where the commitment has been there for a long time and it was a matter of showing countries how they could actually manage it, with Guinea worm most people are unaware of the problem until they're faced with the statistics.

I think what's amazing is how rapidly they become interested in this problem. One week they think that there's not much going on in their country, and then they start seeing the reports. And when people realize how simple it is to really end this disease. People have become very interested.

On the question of benefit cost or cost effectiveness, it seems to me that the way we should be looking at this is not with two different standards. Hospitals aren't held to a benefit cost ratio or even a cost effectiveness standard. Somehow prevention programs are and I think this is a big mistake that we've gotten into.

The prevention programs should be funded because of quality of life issues. And Guinea worm is certainly a quality of life issue.

One other thing let me mention, even in the villages it's frequently the case that the villager does not relate this disease to contaminated water. So that an education process has to take place both with the heads of governments, but also at the village.

When you have a 12-month incubation period, it's like trying to convince people that they get emphysema from cigarettes. The incubation period is so long it's hard to get that point across. And here people frequently think it's for some other reason.

In the area where I lived in Nigeria, people were convinced that they got Guinea worm from the praying mantis because you could dissect certain praying mantises and find a long worm that would unfold and look similar to a Guinea worm. So that was the first step, just educating people that it's the water that causes it.

Mr. HALL. Thank you. Let's go to Dr. Hopkins. Dr. Hopkins, both you and Dr. Bourne referred to an opportunity for leadership in this global initiative to eradicate the Guinea worm disease.

Could you describe the nature of this leadership role and also what role you think the U.S. Government should take?

Dr. HOPKINS. Thank you, Mr. Chairman. I would say first of all that we have a kind of precedent in the smallpox eradication program. Clearly neither the United States nor any other single country can take care of this problem alone.

We have the beginnings of leadership of this as a result of the World Health Assembly resolution which was taken last May at the 39th World Health Assembly. But I think what is still needed is for persons involved with a developing agency, with the major U.N. agencies, to really come forward and more aggressively embrace this goal.

Dr. Bourne has mentioned that the steering committee of the Water and Sanitation Decade passed a resolution establishing Guinea worm elimination as a subgoal of the decade in 1981. But we really have not yet seen other than the World Health Assembly resolution the major agencies concerned, bilateral as well as international agencies yet, really embracing this goal in the way, for example, that many agencies did the smallpox eradication program.

One might point, for example in comparison, to the onchocerciasis control program in West Africa now. It originally started about 10 years ago for the very similar reasons. There one had a parasitic infection which affected people. It didn't kill them. In this instance it blinded them and made them unable to work because of it, and the association in that instance with flowing rivers, people abandoned very fertile areas of land.

There one has a 20-year projected program at a cost of about $18 million a year which is needed to improve the quality of life for people in these areas, as well as to permit them to farm. And there again it was a disease which wasn't dramatic in the sense of diseases, some epidemics which kill people.

In Guinea worm one has a similar kind of problem. It does not kill people. Also it's associated with water. It does keep people from taking advantage of farming opportunities and improving their livlihood.

I think in that very same area as well as a larger area of Africa for a fraction of the cost of controlling onchocerciasis one could expect to eliminate Guinea worm disease.

The kinds of things that are needed, I would say, include apart from the public embracing this, is the support for countries to develop plans, support for in instances where projects already exist, related projects, in endemic areas to take cognizance of Guinea worm disease and other kinds of help in the form of consulting epidemologists, et cetera, to help countries to implement such plans. All countries have some water supply activities going on now. They all have health education activities.

What's needed in individual countries is to find out where the Guinea worm is and then focus efforts on those parts of the country. It's only a fraction of the villages that are effected by Guinea worm disease.

Another final potential benefit of this is that with all these myriad of problems, as Dr. Lucas has mentioned, this is one that we can take out. And in the process we can give people the basis for hope and show them some very visible important improvements in their lives.

Mr. HALL. One of the things that all of you have said that is very interesting in regard to this horrendous disease is the fact that it might have been around for 4,000 years, but eradicating it through some very simple methods is very doable. We're not talking large amounts of money. Actually we're probably talking about new leadership, new direction, new commitments more than money.

Is that what I'm hearing?

Dr. BOURNE. Yes, that's exactly right.

Mr. HALL. Congressman Bereuter.

Mr. BEREUTER. Thank you, Mr. Chairman. Thank you for your testimony. I'm sorry, I had a conflict at the beginning. I tried to catch up here.

Did I understand one of you gentlemen to say that there is no animal reservoir for the Guinea larvae?

Dr. HOPKINS. That's correct.

Mr. BEREUTER. That means that it's found only as far as in an organism in the human body?

Dr. HOPKINS. That's correct. And in the cyclops.

Mr. BEREUTER. Right. Should the aim of U.S. policy or international policy therefore be aimed at education and control of the program, or do we have an opportunity to eradicate the parasite?

Should we approach it on the parasitic basis?

Dr. HOPKINS. I would say that we should aim to eradicate them, and there should be no bones about that, that it's justifiable, it's certainly doable, it has been done in some regions of countries and some entire countries. There's no reason to say that we can only control this disease.

The risk of only controlling it is that one might have a natural disaster or some man-made catastrophe that would recreate circumstances under which people could be reinfected in some areas.

Mr. BEREUTER. Can we kill the larvae without having clean water?

Dr. HOPKINS. Yes. The temephos can be used at a recommended concentration of one part per million to kill the larvae and the worm without completely cleaning up the water.

Mr. BEREUTER. It seems to me that the incredible amount of funds that the world—individual countries, the United States

through AID, aimed at water projects you have only a secondary benefit in disease control and control of the Guinea worm parasite. And that kind of reliance upon secondary impact is not going to provide us clean water in all of those areas.

I cannot imagine how we're going to have in the short period of time that we'd like to see left for this life on Earth of the Guinea worm parasite the kind of resources necessary to clean up water in all of those areas.

Education programs are a very difficult process as well. So I'm wondering what is the shortest, and it almost means least expensive to be the shortest, way of proceeding to eliminate the last infected human?

Dr. HOPKINS. Some of my other colleagues may want to respond as well.

Mr. BEREUTER. The last human who has an infection. Let me clarify that.

Dr. HOPKINS. I think again one of the things that's most hopeful about this infection is that its distribution is sporadic. All countries have some water supply things going on now.

The thing that distinguishes villages that have Guinea worm, which also don't have safe drinking water, from other villages which also don't have safe drinking water but which do not have Guinea worm, the villages with Guinea worm have all the problems with viral diseases, scabies, and all those other water-associated diseases. And then, on top of that, they have this horrible problem that we've been talking about.

So I think one beginning sort of philosophy would be within the constraints of finances, of geography and all of that, to give some greater priority to those villages which have Guinea worm because that's where the maximum benefit of providing safe drinking water is going to occur.

In an individual effected country, those villages we estimate constitute less than 5 or 10 percent of all of the villages which don't have safe drinking water. So to get rid of this, one could have safe drinking water and every village that has Guinea worm disease, even if one is falling far short of the goal of providing safe drinking water to everybody who doesn't now have it.

Mr. BEREUTER. That assumes, of course, that we don't have mobility. We do have some mobility.

Can we take the approach that was taken in Panama to eliminate the mosquito that carried the malaria infection? We didn't provide safe drinking water to all of Panama all of a sudden. We just got rid of the environments in which the parasite could live.

Can we now—is there some fashion that we can kill all the parasites without having to wait for clean drinking water throughout the area?

Dr. HOPKINS. We have temephos, yes, to kill the parasites. We put it in sources of drinking water. One also has health education to educate people as to how——

Mr. BEREUTER. Doesn't it mean you have to put it in every significant puddle in that area?

Dr. HOPKINS. From which people are taking drinking water, yes.

Mr. BEREUTER. And how do we proceed with an international program to accomplish this?

Dr. HOPKINS. Well, I think there are multiple things which need to be done. Among them is to coordinate related efforts among the bilateral development agencies as well as the international agencies concerned, particularly WHO, UNDP, UNICEF, and the World Bank.

Mr. BEREUTER. I think someone here wanted to say something.

Dr. FOEGE. Yes. I think that we're fortunate in that this should be simpler than smallpox eradication, where we had only one tool which was to vaccinate. I think there are three approaches to Guinea worm. Any one alone could theoretically eradicate this disease.

One would be safe water supplies. And that's the preferred one where you can do it because of all the other benefits you get from it.

Mr. BEREUTER. I think it's too slow.

Dr. FOEGE. But the second one, where you can't do that, is the treatment of water with chemicals. And that should be theoretically able to get rid of Guinea worm.

A third, if you couldn't do that, it should be possible through health education by boiling water or using the kind of filter that Dr. Hopkins has at the end of the table there. It's possible to get rid of Guinea worm.

It's the combination of these three, not waiting for clean water supplies where you can't get those, using something else that will do this. It's also a little more complicated than it sounds. In villages in India, for instance, with a caste system, there may be three or four or five sources of water that different castes use and you can't simply change the whole sociology in order to have them use the one clean water supply that you bring in. You have to use combinations of approaches just in one village.

Mr. BEREUTER. Thank you. What is the expense of the material that would be used, the liquid?

Dr. HOPKINS. The temephos in this bottle is about 50 cents, a little under 50 U.S. cents worth.

Mr. BEREUTER. And what would it treat, that 50 cents worth?

Dr. HOPKINS. That would treat, I think it's 15 cubic meters. A liter of—this temephos costs $16.50 U.S. and that would be enough to treat 15 cubic meters of water which would be a body of water 5 yards by 3 yards by 1 yard.

Mr. BEREUTER. Could we reduce the cost of that, say, by to 10 percent of what it's now costing if we set about to produce it in massive quantities?

Dr. HOPKINS. I don't know the answer to that.

Mr. BEREUTER. I think you had something you wanted to say?

Dr. BOURNE. Yes. I just wanted to follow up on the question. I think that we've seen in India that the multifaceted approach to getting rid of this problem really works. What we've seen in the last few years in India is a systematic identification of each village where a Guinea worm remained, and then a careful examination of which of these methods or combinations of methods would get rid of it from that community. And this approach has worked extremely successfully in village after village in getting rid of it.

The other thing in terms of the process is that last summer in Nyeama, Niger, a conference was held involving all of the African

countries where Guinea worm is still a problem, which Don Hopkins and I attended. At that meeting the representatives of each country made a commitment to develop a national plan to begin to eradicate the disease, which means in Nigeria, Ghana, other countries, initially going out and finding every village where this disease still remains, and then doing as they had done in India, looking at which of these methods is most appropriate.

Obviously it is not going to involve providing clean drinking water in every place. But if you can convince people with education that this is how they got the disease and get them to filter it, you've solved the problem just as effectively.

Mr. BEREUTER. Yes?

Dr. FOEGE. To follow up on India, I attended their annual meeting in 1985. They had gone from about 14,000 infected villages just 2 years earlier, down to about 8,000. So that's the speed with which this can operate.

We know that a good system in a village within 2 years should take them from wherever they were to zero. That shows by using this combination approach, not trying to get safe water where it just isn't possible, but to get chemically treated water, that you can within a period of years reduce the number of total villages that are infected.

Mr. BEREUTER. What has the World Health Organization done about this?

Dr. FOEGE. They passed a resolution last year which is quite significant because it's the first resolution calling for the elimination of a disease since smallpox days.

The World Health Organization is now actively pursuing this goal. Dr. Hopkins heads up a collaborating center of the World Health Organization.

Mr. BEREUTER. Are they putting any money into it or are they passing resolutions?

Dr. HOPKINS. The WHO has put some small amounts of money into it. As you know, right now they're facing a severe financial situation. One of the ways in which they are uniquely—have been especially helpful in this has been in convening and serving as one of the cosponsors of various meetings which have been held. They cosponsored the regional meeting in Africa last year. They are intending to cosponsor the second African regional meeting on this disease in March 1988, a year from now.

They've also developed a slide—to help in the training of people around the world.

Mr. BEREUTER. I sometimes find it very discouraging that the World Health Organization wouldn't have been involved in this operation some time ago with the very large African participation in the United Nations.

I sometimes do wonder what that organization in New York really does with the funds that we give them. Obviously the United States cannot take this on alone. We can make contributions additional to the World Health Organization, but it seems to me you have to have some international effort to pursue this effectively.

We already have an organization that I understand is charged with this responsibility. What do they do with their effort besides

pass resolutions recently? This is a 2,000 year old problem. We've had the United Nations operating for a long period of time.

Why—I guess I'm asking a rhetorical question to focus my irritation with the World Health Organization. But anyway, you want to respond and defend the organization—success, let me know.

Dr. LUCAS. Thank you very much. First let me declare my interest that I worked with the World Health Organization for 10 years, and I'm just coming off of their books. I think the work of the World Health Organization has contributed through support of activities in the water decade. The Water and Sanitation Decade has been one of the areas of WHO's work.

I was in charge of their program for research in tropical diseases, which included a wide variety of parasites from malaria right on to Guinea worm. We did look at the problem of the Guinea worm. It seemed to us in that program that we should go more for the education and social type research. One of the things that had been assessed indicated the production of the nylon filters which have been used in villages, in village communities, for dealing with this.

Another example of WHO's work deals with the disease river blindness. In areas where 15 or 20 percent of the adults were blind, we now have a situation where children under 6 are no longer infected.

I was in charge of the program to develop drugs for the treatment of river blindness. And with one of the drug companies in this company we now have a drug that's about to be registered for human use which seems to be very highly effective in dealing with river blindness.

But at all times what I felt and what WHO is a very severe financial constraint. I think the total annual budget of WHO was around—it decends for all of the activities that have to be done globally. We're talking about $250 million a year for all of the activities globally.

For the research work we were trying to do on malaria and things of that sort we were spending between $20 and $25 million globally. We all know that even to develop one drug industry is talking about $50 million compound.

Mr. BEREUTER. Thank you very much. Maybe the United Nations ought to focus more on the matters of survival at the beginning.

Dr. FOEGE. I am not an employee of WHO, but I would like to come to their defense. In the smallpox eradication plan——

Mr. BEREUTER. Not at too great a length.

Dr. FOEGE. It couldn't have been done without them. The United States now saves more money each year, because of smallpox eradication than we put into WHO. WHO went from that to the expanded program of immunization, and now two-thirds of the Third World children have a first dose of some vaccine. They went from that to the dracunculiasis program.

These money constraints are very significant because last year the United States did not pay its commitment to WHO. Of the $61 million it owed it only paid $10 million. So WHO is in a terrible position, but I think they've done a great job for health globally.

Mr. BEREUTER. You know that the reputation of the United Nations is deteriorating in this country and certainly in this Congress. The kind of money we're putting into it now is being held and cut

back for a variety of activities that I think really have nothing to do with the World Health Organization component in it.

But it seems to me we're talking, if well organized, about a relatively small amount of money considering the suffering and the opportunity—something that's been going on since time and memorial. Perhaps if there was a little more demonstrated commitment in this area at the moment it might change the whole attitude that the Congress has about the American contribution to the United Nations.

I want to thank you. It's been very informative and I've learned something from your answers and have been encouraged with the opportunities to eradicate the disease. I hope that we take the short approach and not do this through water projects because that's a long, long approach.

Thank you, Mr. Chairman.

Mr. HALL. We want to thank all of the witnesses. We're very appreciative of your time and certainly have learned from your expert testimony. It's been very informative for us. We hope to be able to provide leadership from our Government. Thank you.

Our next witness is from the Agency for International Development, Mr. Kenneth Bart. He's the Director of the Office of Health of the Bureau for Science and Technology.

Dr. Bart, we look forward to your testimony.

STATEMENT OF KENNETH J. BART, M.D., AGENCY DIRECTOR FOR HEALTH, BUREAU FOR SCIENCE AND TECHNOLOGY, U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT [AID]

Dr. BART. Mr. Chairman, thank you for the opportunity to be here. I'm pleased that you invited the Agency for International Development to appear before the committee. I'd like to take a few minutes and discuss our efforts to control dracunculiasis.

I'm sure as you're aware by now having heard expert witnesses that Guinea worm clearly is one of the long list of debilitating and sometimes life-threatening diseases related to both water and sanitation. These range from water-borne diseases such as diarrhea, hepatitis, and typhoid to water, so-called water-washed diseases such as typhus and trachoma and scabies and conjunctivitis to water-based diseases such as schistosomiasis, malaria, dengue, yellow fever and onchocerciasis. They're all transmitted by insects which breed in or near water.

It's clear that when clean water is available in sufficient quantities, most of these diseases can be prevented or certainly at least limited substantially. Though not life-threatening, it's clear that Guinea worm disease falls into a category of being severely incapacitating and has a significant impact on agricultural productivity and the productivity of an age group that contributes overall to development.

You've also heard that in the late 1970's there was a resurgence of interest in water supply and sanitation in developing countries which culminated in the United Nation's decade for drinking water supply and sanitation. Since the outset of the water decade in 1981, AID has supported water supply and sanitation projects in some 41

countries in five regions of the world. These are annunciated on table 1 of the testimony which you have.

The total amount of funding provided by AID during this period for this effort totals some $1.94 billion. These projects range from rural water supply projects to primary health care projects with water components, to projects focusing on water-related disease control.

This $1.9 billion represents AID's obligations from development assistance and economic support fund accounts. These clearly do not include host country contributions which are very substantial, Public Law 480 financing which is significant in Africa, and a variety of other sources such as disaster assistance and housing investment guaranty funding of housing and urban development projects.

From the beginning of the water decade some $72 million have been obligated for planned water and sanitation activities in 10 of the Guinea worm disease infected countries. These are annunciated in table 2 of the testimony that you have.

While many of these projects are not specifically aimed at Guinea worm disease, experience tells us that we can expect some diminution of the disease as a result of these activities.

In addition to bilateral water and sanitation projects in Guinea worm infected countries, AID provides a variety of practical assistance to organizations involved in Guinea worm disease control projects. I won't annunciate these in detail. They cover information networks, health education, support for PVO's, collaboration with the Peace Corps, rural well rehabilitation, a variety of technical activities in collaboration with CDC.

But I think it may be useful to talk just in summary about some of these. The health information network has been established to work closely with WHO and CDC and other international organizations. Water supply and sanitation projects clearly to truly benefit people that they're designed to serve and have an impact on health.

These water supply technologies need to be integrated with community participation and health education.

It's clear because of the mode of transmission of Guinea worm that Guinea worm can be addressed through health education.

AID is developing specific guidelines for Guinea worm education. These guidelines are intended for the frontline community health workers; that is, development and extension works from ministries of health, interior, or rural development, as well as ministry of health personnel from nurses down to village health workers.

Most important is the support of PVO's. In recent years AID has made a strong commitment to support private voluntary organizations, especially in Africa. Most of the major PVO's have some water and sanitation or health education projects in Guinea worm infected countries.

For example, World Vision carries out projects in Senegal, Mali, and Ghana. CARE works in Cameroon, India, Mali, and Chad. Save the Children has a project in Burkina Faso. A World Neighbors project in Togo I think is an interesting example of what can be achieved.

Starting in 1981 the project used health education to mobilize a village of about 3,000 inhabitants, of which there were 928 cases of

Guinea worm reported. Starting in 1983 the population helped construct local wells, and by 1985 the incidence of Guinea worm had been reduced to only 7 cases.

AID is about to sign a $2.2 million matching grant agreement with World Vision to help strengthen the organization's ability to plan and design and to implement water and sanitation projects in Africa. AID has also supported a number of project designs and technical training workshops for PVO's.

In 1986 we undertook an indepth study of the effectiveness of PVO's in the water and sanitation sector. The study concluded that PVO programs have considerable strength at the local and community level, but that many PVO's lacked technical expertise in this sector. Consequently, we've given high priority to providing some of the much needed technical assistance to PVO's working in this area.

We've provided technical assistance in the in-service training programs of various Peace Corps groups and to Peace Corps Washington office training and program support. We've supported a staff of volunteer and staff conferences, highly successful special project assistance program. AID has provided funds for the Peace Corps for volunteer projects, another example of that kind of collaboration.

It's estimated that over one-third of the Office of Health SPA projects are in support of improved village and sanitation projects.

It's clear that more needs to be known about the role of water and sanitation activities and the control of Guinea worm, and that there's a need to collect accurate information on the distribution of the disease and to monitor methods of control now being used.

The same drug that Dr. Lucas talked at some length about, which is being used now for onchocerciasis or about to be registered for onchocerciasis, has the potential of being used also for Guinea worm, iberlectin, which may add an additional drug to our list of dealing with this rather unfortunate disease.

In Cameroon, in Burkina Faso, AID and CDC recently completed a national epidemiologic Guinea worm disease survey. Each includes a national action plan for control as a result of these activities, basic methodologies for conducting cost effective surveys, and evaluation techniques have been developed.

But last, and most important, I'd like to take a moment and describe AID's approach for the future. I'd like to turn to a description of AID activities and what more AID intends to do to decrease the incidence of Guinea worm.

Our approach is essentially two-pronged. First, from a quick survey we know that at least 80 water and sanitation projects in Guinea worm infected countries funded by a variety of PVO's and international organizations. Where there are ongoing water and sanitation projects, whether they're funded by AID or others, we are prepared to provide technical assistance to improve the impact of those programs on the control of Guinea worm.

Second, AID stands ready to help with surveillance of existing control projects, epidemiological mapping of the disease, and technical support for countries to develop national plans for the control of Guinea worm.

For those water and sanitation projects without a Guinea worm control component, one could be added. Information on the disease, health education materials, and guidelines on how to add a Guinea worm disease component are all available.

To enhance current Guinea worm disease projects, hygiene education workshops for health workers in the field are clearly needed. Rehabilitating and improving existing water sources and constructing new sources also would be considered.

Finally, AID stands ready to provide assistance in social marketing for control of Guinea worm disease for interested countries. Social marketing uses the radio, printed material, person-to-person contacts, to encourage the simple modifications in behavior that can potentially prevent Guinea worm disease.

In conclusion let me note, Mr. Chairman, that AID has long been concerned about the heavy toll that inadequate water and sanitation takes on the health of citizens of the developing world. We're pleased at the attention this committee has directed at this important problem, and we look forward to close cooperation with WHO, CDC, the PVO community and national governments to improve control of this unfortunate disease.

Thank you.

[The prepared statement of Dr. Bart appears at the conclusion of the hearing, see p. 59.]

Mr. HALL. Thank you, Dr. Bart. As I look at the reports concerning the actual expenditure of money concerning funding for water and sanitation projects in the various years, I note that U.S. AID has spent about $2 billion on water projects since 1981, but only a few million for rural water supply.

For example, in fiscal 1984, $197 million was spent for urban water and sanitation programs in Alexandria and Cairo, and yet that same year funding for water and sanitation projects in Africa amounted to only $8 million.

In fiscal 1985 the total funding for water and sanitation activities increased to $267 million, but funding for water and sanitation activities in Africa dropped to $6.5 million. There's obviously a very strong regional bias to that kind of spending.

But it seems the tremendous overwhelming problems related not only to Guinea worm disease, but to other diseases, are so lopsided. As you look at urban spending versus the rural spending, you find no relationship to the security of health problems I would like to know why this is and what is the actual expenditure percentage-wise for rural water supply development.

Dr. BART. Let me try to address the first part of your question. What you see is a skew, an apparent skew, between urban and rural investments. I think you need to—as you look at these data the fact that ESF support for Egypt needs to be removed. When one does that, I think you'll see it balanced.

I think what is more important is not the relative investment of urban and rural, but an overall lack of investment in water and sanitation over time. And I think that may be the point that you're concerned about.

It is clear that the Agency has chosen with the guidance of this committee and others to focus its health activities, and particularly focus them on child survival activities. Our investment within

those activities have risen year after year. And in a zero sum gain in which Gramm-Rudman and others press the total budget, we find that the investment that Dr. Foege described, supported WHO and others.

In EPI there's an expanded program on immunization, diarrhea, as necessitated, skewing resources away from water and sanitation. Our investment in water and sanitation has been reviewed because of the difficulty of formerly institutionalizing the water and sanitation efforts, the maintenance of such programs, the lack of managerial skills, the long-term investment, and the kind and quality of resources that are required as necessitated choices; a focusing of resources where impact could be obtained in the short-term and they've been on the principal child survival activities.

So yes, the overall investment has fallen in water and sanitation. No, there is not a skew between urban and rural. What you're seeing is an investment, I think, and an equal, but falling investment overall in water and sanitation. Principally that results from an issue of choice; that is choice for child survival activities as opposed to the more difficult institution building which we have found associated with the development of the institutions necessary to both provide and maintain and ensure the continuing supply of water and sanitation, particularly in urban areas.

I should hasten to say, however, that we have an extensive water and sanitation project which maintains a single focus on this institutional capability. It is not a dollar intensive, but a technical program principally invested in working with governments to develop that institutional capability to maintain water and sanitation facilities; management skills, replacement of parts, the routine managerial issues that make all organizations function are clearly more problematic in the water and sanitation areas.

This project is now in its second generation. It has been widely sought after both by the international agencies and host countries, and is in many ways a premiere success.

I don't think I addressed your second question that had to do with resources directly invested. Do you want a specific dollar response?

Mr. HALL. I'm more interested in a percentage. You can furnish that for the committee. You referred to this committee as being very interested in pushing child survival. That's very true. We have stressed it. We have pushed legislation through Congress. We have worked with AID We have pushed the Government to really take a leadership role, and they have.

On the other hand, child survival is related to dirty water, which is related to basic education, which is related to tetanus and infection. It's related to death, to child mortality rates, and to ORT, which we have always stressed in this committee.

And so, it's not that Guinea worm disease is separate from everything else. It goes with child nutrition. It goes with infection. We, in this committee are not talking about large amounts of money. We're just talking about new leadership in this area.

One of the problems that we're having, I understand, is that there is nobody with responsibility for Guinea worm disease in AID. We would like to know who that person is because we would like to continue to check on the progress of Guinea worm disease.

We want to stay very, very close to it because we think it all ties into child survival. We're asking AID to provide leadership, direction, and commitment. Who does have responsibility in AID for the eradication of Guinea worm disease?

Dr. BART. We don't have the kind of segmentation or stratification that would make us responsible on a disease-specific basis. As the Agency Director of Health, I have ultimate responsibility for all of our activities.

We have a division responsible for better—waterbone disease. That division has complimented in a number of countries, so our vector bone disease control project has complimented a number of countries already with CDC in the development of national plans. We have contributed very substantially to the work and preparation with governments.

Not all governments have recognized the importance of Guinea worm as a priority. Not all governments have been willing to invest resources. WHO has not yet demonstrated the leadership or willingness to invest either human or fiscal resources in this problem. It's an issue of priority setting.

We understand your concern. We are prepared to increase our investment and our interest in this project. We are able to do it through our current water and sanitation project. We believe that there is an opportunity. We would like to be able to provide additional investment and we plan to do that.

We planned to do that more than a year and a half ago when Dr. Hopkins and I talked at some length about opportunities between our agencies, CDC and AID. We continue on that road.

To consider a time limited program in the face of resource constraints forces us, as everyone, to establish priorities. And we have. We have not made this the highest priority on our program, but we believe within our water and sanitation programs there is an opportunity for us to fill the perceived vacuum.

We're pleased with others to do that. I think AID or any agency will not at this particular time be able to fill all that vacuum. There simply aren't the resources.

A recent benefit cost study estimated that for the chemical response which Dr. Hopkins demonstrated to be a solution—that is, the providing of chemical sterilization, if you will, of those wells at roughly $4 per capita—and if you're talking about $140 million at risk, that's a generous amount of money. And if that's to be repeated twice, we're talking about estimates which approach $1 billion.

I think we must consider every opportunity to eradicate a disease which has a simpler life cycle as this. I think that we can do more and we are planning to do more. I think we can give the kind and quality of attention that this disease deserves. But I think we cannot give it the kind and quality of priority that other child survival activities clearly demand.

It's a disease that provides morbity, not mortality. Not that it doesn't have a very significant burden on development. It does. And we're appreciative of that and we plan to use all of our resources as extensively and as efficiently as we can with our water and sanitation projects, with our vector bone disease control projects, to enhance our focus on Guinea worm.

Mr. HALL. I appreciate your honesty in the way you answered that question. One of the things I wanted to hear is that it's increasing in priority and that money will be committed to eliminating Guinea worm disease.

Hopefully, through this committee and the Congress we can work with you and help you with it. We feel that it is relative to child survival, malnutrition, and hunger.

As we have heard today from our witnesses, eradicating this disease is really possible.

I thank you, Dr. Bart, for your testimony. I have some questions that I would like to submit to you that I've not asked today. That will conclude the hearing.

[Whereupon, the committee was adjourned at 11:15 a.m.]

[Material submitted for inclusion in the record follows:]

Prepared Statement of Hon. Mickey Leland, a Representative in Congress From the State of Texas

I JOIN IN WELCOMING OUR WITNESSES TO THIS HEARING AND LOOK FORWARD TO LEARNING MORE ABOUT WHAT IS A DREADED AND DEBILITATING DISEASE AMONG RURAL RESIDENTS IN DEVELOPING COUNTRIES.

TIME AND TIME AGAIN WE ARE TOLD OF THE IMPORTANCE OF SAFE DRINKING WATER AND ADEQUATE SANITATION FOR HEALTH, AND ESPECIALLY FOR CHILD SURVIVAL. THE MAJOR KILLERS OF CHILDREN IN THE DEVELOPING WORLD ARE WATER-BORNE OR WATER-RELATED DISEASES. MEMBERS OF THIS COMMITTEE HAVE BEEN AT THE FOREFRONT IN ADOPTING

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MEASURES WHICH WILL INCREASE CHILD SURVIVAL. INCREASED AVAILABILITY OF FOOD, ORAL REHYDRATION THERAPY AND IMMUNIZATIONS ARE HAVING AN IMPACT. CHILD MORTALITY IS DROPPING. BUT, FOR SUSTAINED, LONG-TERM GAINS IN CHILD SURVIVAL AND SUSTAINED IMPROVEMENTS IN CHILD AND ADULT HEALTH, IT IS ESSENTIAL THAT ACCESS TO POTABLE DRINKING WATER AND ADEQUATE SANITATION BE IMPROVED.

THE PROBLEM WE ARE GOING TO LEARN MORE ABOUT TODAY, GUINEA WORM DISEASE, IS LESS WELL KNOWN THAN DIARRHEA, MALARIA,

SCHISTOSOMIASIS AND OTHER WATER-RELATED HEALTH PROBLEMS. AS TERRIBLE AS THESE DISEASES AND THEIR CONSEQUENCES ARE, AND THEY ARE TERRIBLE, IT IS DIFFICULT FOR ME TO IMAGINE A DISEASE MORE DEHUMANIZING THAN GUINEA WORM DISEASE. I AM HOPEFUL THAT AS A RESULT OF THE INFORMATION AND RECOMMENDATIONS PROVIDED BY THE WITNESSES AT TODAY'S HEARING, WE WILL BE ABLE TO AGREE ON A ROLE TO BE PLAYED BY THIS GOVERNMENT IN THE GLOBAL BATTLE TO ERADICATE GUINEA WORM DISEASE.

Prepared Statement of Peter G. Bourne, M.D., President, Global Water and President, American Association for World Health

Mr Chairman, members of the committee it is a great pleasure to appear before you this morning. I would like, on behalf of the many millions of people in the world afflicted with guinea worm disease and the millions more who still do not have access to clean drinking water, to take this opportunity to express special appreciation to you for holding today's important hearing on this vital topic.

I am Dr Peter Bourne, President of Global Water a non-profit organization concerned with the provision of clean drinking water to people in the Third World, and President of the American Association for World Health. I was formerly an Assistant Secretary General with the United Nations. In that capacity I was responsible for organizing and launching, in 1980, the International Drinking Water Supply and Sanitation Decade, a ten year program aimed at bringing clean water and sanitation to people throughout the world.

The appropriate development of water resources is the single most important factor in improving the quality of life for the rural poor in the developing world. The crucial importance of irrigation in enhancing food production is understood by everyone. It comes as no surprise that India, which is today food self-sufficient, has irrigated 60 per cent of its agricultural land, while in Africa the figure remains close to 2 per cent. Regular watering of livestock will not only improve their overall health, it will increase milk production in cows as much as 50 per cent, particularly benefitting the young children in a community.

It is the provision of clean water for human consumption, however, which has the most far reaching effect on the health and nutrition of the people in the developing world. Of the 12-15 million children, under the age of 5 years, who die in the world each year the majority are killed directly or indirectly due to the lack of access to

clean water and sanitation. Half of all the hospital beds in the world are occupied by people suffering from water related diseases. We have only to look at the history of our own country to see that it was not miracle drugs, faddish technologies, or even immunization programs that were responsible for so dramatically reducing infant mortality rates in this country in the first half of this century. It was instead due primarily to the provision of clean water and sanitation. In addition to the obvious relationship between water and health there are other less immediately evident connections. Throughout, the developing world it is the invariably the job of women and children to fetch the daily water supply. It is not unusual, especially in Africa, for a woman to walk five or more miles a day to collect the gallon or two necessary for her family's bare survival. The scarse human energy of the already most malnourished is unnecessarily expended for this purpose, and hours that could otherwise be put into other more healthy and productive activities are squandered.

In the 1970s there was a growing concensus among those experts most knowledgable about hunger and poverty in the Third World, that, not only could we no longer tolerate morally a situation where half of the world's population still did not have access to clean water and sanitation, but that, if addressed, this was one of the most profound, lasting, and cost-effective ways of intervening to alleviate the suffering in the lives of the world's billion poorest people. In 1977, the United Nations convened the World Water conference in Mar del Plata, Argentina. At that meeting, with the United States delegation as a prime instigator, a resolution was passed calling on the United Nations to establish an International Decade for Clean Drinking Water and Sanitation. That ten year program was officially launched at a unique special session of the United Nations General Assembly on November 10th 1980. At that ceremony the Secretary General of the United Nations said, "No program ever launched by the United Nations offered greater hope for improving the quality of life for the people of the developing world."

To implement the Decade program. Each developing country was asked to set up a national action committee comprised of those cabinet members whose ministries were most directly involved in handling water resources. Those committees were then asked to develop national action plans, blueprints for how their country would, over the next ten years achieve the Decade goal of "water and sanitation for all" or achieve as close to full coverage as they felt was realistic. At an international level the United Nations established a Steering Committee for the decade made up of those UN agencies most directly involved inthe initiative, - UNDP, WHO, UNICEF, the World Bank, and FAO.

Although deadly diseases such as typhoid, cholera and polio are most commonly associated in people's minds with contaminated water, only one disease is transmitted exclusively by drinking water and in no other way. That disease is dracunculiasis or guinea worm. It is a disease that causes staggering disability in tens of millions of people in Africa and Asia each year. It is also a disease that is very easily eliminated by cleaning up the sources from which people obtain their water supply. From the beginning of the Decade this disease was seen as a prime target for the program and, at a meeting of the UN Steering Committee in April 1981, the global eradication of guinea worm was adopted as a sub-goal of the Decade.

My colleagues on the panel will address in detail the specific aspects of the disease and the global eradication strategy. I would, however, like to make two points as to why the guinea worm problem should be of major concern to this committee. First, while all waterborne diseases contribute to malnutrition and reduce people's productivity, the correlation between the presence of guinea worm in a community and the decline in food production is particularly dramatic and well documented. This is attributable to the fact that the debilitating aspects of the disease tend to occur during the planting or harvesting season for crops, the very time when people most need to be healthy and able to go to the fields. Reports from many sources, including the World Bank, have shown that the decrement in food production in guinea worm endemic areas is consistently 30 per cent or higher. This means that in a broad swathe across sub-Saharan Africa, a major part of Pakistan and part of India, people who otherwise could feed themselves are prevented from doing so merely because they are afflicted with this specific preventable disease.

The second point I wish to make is that not only is guinea worm relatively easy to get rid of in an individual community, but we have within our grasp the possibility for eradicating it completely from the globe, so that, like smallpox, we would never have to worry about it again. What is particularly crucial about this moment in history is that because of the Water Decade we have the attention of the governments of the developing world focussed on the provision of clean drinking water for their people and the necessary international momentum mobilized to bring this campaign to a successful and dramatic conclusion. We may not realistically be able to provide everyone in the world with clean water by the end of the Decade in 1990, but we do have the potential to make the eradication of guinea worm the lasting legacy of the program. It is an objective with which I believe this committee and the United States government would want to be closely identified.

In the period since it was launched the impact of the Water Decade has been considerable. During the first six years safe drinking water has been provided to close to 300 million, and nearly 140 million have received sanitation facilities. There has been a 14 per cent increase in rural water supplies, surpassing the achievement of the entire nineteen seventies. The total population served by water facilities in the urban areas has risen from 74 per cent in 1980 to more than 80 per cent today.

There have been important breakthroughs in the development of low-cost appropriate technologies for well drilling, in designing and manufacturing easily maintainable handpumps, in low-cost sanitation, and in the overall development of groundwater resources to meet the needs of rural populations.

The accomplishments of the Decade vary region by region with Asia being the area of greatest success. This is attributable to several factors. First, in Asia the Decade comes historically at exactly the right moment in the overall development process, fitting sequentially as the logical next step in the governments' overall effort to improve the quality of life for their people. Second, the economies of most Asian countries are relatively healthy and they are able to make the necessary capital investments to provide water and sanitation services. Third, they have well developed infrastructures, including strong academic institutions, as well as government bureaucracies capable of implementing complex programs. Fourth, there has been in the region almost universal public endorsement and leadrship for the Decade program by heads of state and government, some with passionate enthusiasm.

India provides a particularly good example of what the Decade has been able to accomplish. Strong government support existed from the beginning. Each state was asked to prepare a ten year plan for the Decade and these were then combined to form the national plan. The chief engineers of all the states who had never previously met as a body are now meeting on a regular basis to coordinate the implementation nationwide. In the most recent five year plan $5 billlion was allocated for water resource development, a dramatic increase over previous levels. India is now producing more than 100,000 hand pumps a year, a rate that will provide atleast one for every village in the country by the end of the Decade. A low-cost urban sanitation project, originally started on a demonstration basis by the World Bank, has been expanded by the Indian government to 250 cities. India will not achieve full coverage of its population by 1990, but it does anticipate that 70 per cent of the population will have access to clean water by then, a quantum leap over the 30 per cent covered before the Decade began. Furthermore a process will have

been set in motion that will ultimately result in universal coverage.

It might be argued that India is only one country, as indeed it is. However, in aggregate India, Pakistan, Bangladesh, and Indonesia contain more than 50 per cent of all the unserved people in the world. Success in those four countries alone would make the overall program a remarkable accomplishment. In addition, after a slow start the Decade is now beginning to have a significant impact in Africa.

All of this has been accomplished during a period of unprecedented austerity for most developing countries, and at a time when most bilateral aid agencies and multilateral organizations were cutting their budgets. It is a reflection of the priority which the governments of most developing countries attach to the Decade that its program still proceeded so successfully and that the governments of these countries have been prepared to set their priorities in such a way as to pick up such a high percentage of the overall cost.

Although the United States was one of the instigators of the Water Decade, with the Administrator of AID in 1977, at the time of the World Water Conference, promising an additional $100 million a year for rural water programs for each year of the Decade, our subsequent follow through has been an embarrassing failure. Although the funding of rural water projects did increase fourfold between 1977 and 1980 it has gone steadily down each year since then. This has been despite repeated public statements by members of this administration claimimg the US government's continued commitment to the International Water Decade. Although a 1983 study showed the total AID expenditure for water and sanitation was $850 million a year, a significant part of AID's overall budget, the figure is distorted because it includes several massive urban programs, including most notably the five year $1 billion Alexandria and Cairo sewage project, totally obscuring the decline in support for rural water initiatives. Despite its supposed commitment to the Decade, AID has turned its back on the rural population, the primary target for the program. Where rural projects have been funded the leadership has almost invariably come from the field, not from Washington.

Despite the critical importance of water and sanitation in rural development there is no identifiable item in AID's legislation to identify funds to support this activity. Water and sanitation activities must compete for funding with established accounts, especially health. In 1979 water and sanitation represented a third of the total health account. Today it is closer to a twentieth. This means among other things that the number of technically

competent professionals available in AID to oversee priority setting, decision making, and expenditure of a large segment of AID's budget has fallen to a dangerously low level. It is inevitable that incompetent decisions are getting made involving large amounts of money by people who not only lack the appropriate expertise but also no longer receive advice from people who knowledgable in this field. Part of the problem is organizational. The Water and Sanitation Division was ~~is~~ buried in the Office of Health, which is a part of the Directorate of Health and Population, which is a part of the Bureau of Science and Technology. The Water and Sanitation Division now has been eliminated.

Ironically, despite the de-emphasis of this key element in rural development and health by the leadership at AID, it is an AID project dealing with rural water supply which is one of the most widely acclaimed of all of AID's activities in the Third World. The so-called WASH project (Water and Sanitation for Health) was established in 1979 to support the Water Decade by providing flexible technical assistance backstopping the Regional Bureaus, and AID missions. Operated on a contract basis and funded at a modest level of between $3-4 million per year it has provided a superb and greatly appreciated technical service to governments throughout the Third World. Unfortunately despite the competence of the WASH staff its input seems to be largely ignored at a policy making level within AID.

The discrepancy between the knowledge and competence of the WASH staff and the absence of such input at a decision making level in AID is particularly reflected in the recent failure to include rural water and sanitation programs in AID"S new "Child Survival" initiative. This extraordinary omission can be explained at best on the basis of ignorance on the part of those involved in making the decision, and at worst as being a reflection of a cynical desire to exploit the issue for its maximum public relations benefit without any real intent to try to improve the quality of life for children in the Third World.

Similarly AID'S failure, to date, to support aggressively the guinea worm eradication intiative seems attributable to a lack of konowledge or of sufficient technical input at a policy making level for the importance of an issue such as this to be understood. There have been important gestures of support by individuals at a lower level, for which we are grateful. However, a full commitment at a policy making level has been absent. I hope this hearing will help to change that situation.

However, I believe that an appropriate level of support for the guinea worm initiative can come only

within the context of a dramatic reassesment of AID's overall involvement in rural water and sanitation. In this regard I would like to make the following recomendations.

(1) That the AID Administrator be asked to make an internal management study to review the manner in which appropriate technical expertise in the area of rural water and sanitation is introduced into policy making and priority setting within the agency. This study should be provided to the Congress.

(2) AID should be encouraged to recruit more direct-hire staff with a proper mix of technical skills to address the interdisciplinary nature of the water and sanitation sector. In particular these should include people capable of integrating appropriately water and sanitation into AID's overall health program.

(3) AID should create a new Office for Water and Sanitation, separate from the Office of Health, reporting directly to the Director of Health and Population, Bureau for Science and Technology.

(4) AID should establish a separate line item for water and sanitation in its Development Assistance Annual Budget Submission.

(5) The Bureau for Science and Technology and the Regional Bureaus should give special attention to investigating opportunites for investment in rural water supply projects, and funds should be made available to support this increaded activity.

Finally I would like to add that within the United Nations system, the World Health Organization is playing a major role in support, not only of the guinea worm eradication campaign, but of the Water Decade in general. The failure of the United States government to pay its assessed contribution to the World Health Organization not only represents a violation of a treaty obligation, but severely undercuts the crucial work of that highly regarded agency. Disatisfaction with the manner in which the UN secretariat conducts its business in New York is no excuse for victimizing an organization whose only role is maintaining its longstanding exceptional record of commitment to the health of people throughout the world. I believe the foolowing steps need to be taken.

(1) The cuts need to be restored.

(2) The Kassebaum amendment should be repealed and,

(3) The funding for WHO should be established as a budgetary line item to reflect the treaty obligation that is incurred when the WHO budget is accepted.

Again Mr Chairman and members of the committee let me express to you my deep appreciation for the opportunity to testify before you today and for the interest that you have taken in this issue.

RESPONSES TO QUESTIONS FOR PETER BOURNE

QUESTIONS SUBMITTED BY HON. TONY P. HALL

Question. Your testimony indicates that the U.S. Government is not paying its assessment to the World Health Organization. Is it correct that this Government is not paying what it owes to the WHO?

Answer. Yes, sir; it is correct. This is, of course, within the general context of the funding crisis in the foreign assistance program. WHO, the World Health Organization, is one of several U.N. organizations which have had their funding radically reduced, including the underpayment of treaty-obligated assessments. The WHO assessment for 1987 was originally estimated at $61.71 million. The WHO appropriation from Congress was, however, only $46.07 million of which only $10 million is available prior to October 1. The Pan American Health Organization, the regional affiliate of the WHO, also received an appropriation lower than the assessment and had $12.29 million of that appropriation deferred until October as well.

Question. You have written previously that perhaps 80 percent of the hunger-related deaths in the world stem from water supply origins. Is this astounding statistic correct?

Answer. Unfortunately, it is true that worldwide 80 percent of all disease is linked to inadequate water supply or unsafe sanitation. Every day more than 30,000 men, women, and children die from water-borne diseases; in the developing world, 16,000 children under the age of 5 die each day from water-related diseases. One-half of the hospital beds in the world are filled with people suffering from water-related diseases.

Question. It seems inescapable to classify water supply as a central child survival issue. Is it correct that if we want to do something about the 35,000 or 40,000 children who die each day from preventable disease and malnutrition, we must start funding safe water supplies?

Answer. The provision of a safe water supply is the central child survival issue as far as I am concerned. Many of the child survival interventions—all of which now are absolutely necessary, of course—eventually would not be needed if children in the developing nations had access to a safe water supply and adequate sanitation. Over the long haul, there is no investment we could make with greater impact for more children than providing a reliable, safe, and adequate water supply. It cannot be done overnight, of course, and education on the proper use of a water supply is required for maximum impact. It would not be easy to provide everyone now lacking with safe water. But, eventually, that is what must be done if the Child Survival Revolution is to succeed.

PREPARED STATEMENT OF ADETOKUNBO O. LUCAS, M.D., CARNEGIE FOUNDATION, NEW YORK, N.Y.

PREFACE

Sobia!
Atepe ise
Ajegba ogun maku
Faran owu kan
Ti nmu bale ile su bi eran

Oh! Guinea worm! Walking with you
On the long road to poverty
You defy 200 drugs
One thin cotton thread
That fells stalwart men

A poem about guinea worm in Yoruba (Nigeria). The non-literal translation captures the essence of the original.

GUINEA WORM DISEASE

I am greatly honored by the invitation to give testimony on guinea worm disease to the House Select Committee on Hunger. I know that you have access to various experts who will give you the basic scientific and medical facts about the disease. My main contribution will be the personal testimony of a doctor who had to deal with guinea worm disease in the context of other pressing health problems. I am particularly pleased to be here today trusting that your interest and concern will eventually be translated into increased support for the control of this dreadful scourge. I am making this statement in my personal capacity as a private citizen and not as the representative of any organisation or agency.

Between 1960 and 1976, I worked with colleagues at the University of Ibadan Medical School on the clinical and public health aspects of the problem. We tried to obtain a clearer understanding of various aspects of the problem; we studied the effects of different interventions with regard to the care the individual sick patients and for the control of the disease in the affected communities. The lessons that we learnt confirmed and extended three well-known facts about guinea worm disease:-

(a) Social and Economic Impact on Afflicted Communities

(b) Drug Treatment of Infected Persons

(c) Prevention by Improvement in Water Supplies

Social and Economic Impact of Guinea Worm Disease

My first encounter with guinea worm disease occurred 25 years ago when I was practising medicine in Ibadan, Nigeria as an internist and a public health physician. That encounter had a profound effect on me; it challenged me to know more about the disease and try to do something about it. It was a chance encounter which occurred in the course of a public health survey of the health of schoolchildren. The half empty classrooms in the villages first alerted us to the fact that something was wrong. About one-third of the children who came to school on the day of our visit had evidence of guinea worm infection - the protuding worms, the dirty ulcers, the abscesses and the other manifestations of the infection. We followed them home to see those who were too sick to come to school. We found brothers, sisters, parents and other relatives, many of whom were severely afflicted by the disease.

Some of the patients were ill and in severe pain. Some of the clinical manifestations seemed to my inexperienced eyes wildly spectacular. But beyond the painful sores and the bizarre manifestations, what impressed me most was how this thin threadlike worm had literarily brought whole community down on its knees.

In some villages, up to half of the inhabitants were affected, some were severely disabled and confined to their homes they were being looked after by those who were marginally less ill. Many children stayed away from school, many of the adult men did not go to the farms and the affected women depended on others to carry out their household chores. The few able-bodied individuals had to bear the entire load of keeping the community going during those weeks or months that the guinea worm infection raged. The social disruption was complicated by the economic losses. Peasant agriculture, the mainstay of the community was paralysed by the massive withdrawal of workers who were too sick to go to their farms or who were pre-occupied with looking after their sick relatives. The sick were tending the sick. The traditional extended family system which normally provides the social insurance for individuals who fall sick were being strained to the breaking point. In my career as a public health physician, I have seen the effects of other epidemic diseases - cholera, meningitis and others - but never have I seen any situation in which such a high proportion of the population so suddenly disabled and hed down for such long periods. Most patients recover; a few die from the complications; and some are left with permanent disabilty as for example, when the worm damages the knee joint. Often the relief is short lived. Infections which are acquired during the current epidemic, mature and erupt a year later again to cripple the community.

Nothing in my earlier training had prepared me for this experience. During my early childhood and schooling in Lagos, I saw nothing of this disease except in the class textbook on hygiene. At that time, there was adequate supply of treated pipe borne water for the 120,000 population of the city (now 4-5 million). I saw nothing of the disease during my medical training in the United Kingdom. In the post-graduate course on tropical medicine, I learnt about the structure of the parasite and its life cycle, and about the biology of the small water fleas which carry it in the drinking water. The clinical features of the disease were suitably illustrated by photographs. But until my first encounter with the disease in the field, I did not appreciate that guinea worm disease was such a serious problem. I gained new respect for the disease whem I saw how it could cause a massive disruption of life in village communities.

Our studies and the reports of other public health workers in Nigeria have confirmed the social and economic impact of the disease. Some workers have quantitated the impact of the disease in terms of number of working days lost. Kale (1977) estimated that infected persons were disabled for about 100 days. Ilegbodu and his colleagues (1986) found an absentee rate among schoolchildren was only 2.5% in the villages without guineaworm but it was 21% in villages where guinea worm was present.

Guinea worm disease in Nigeria is a disease of rural agrarian communities. For peasant farmers who are scraping a precarious existence based on subsistence agriculture, guinea worm disease may tip the balance from barely tolerable existence to utter deprivation.

Drug Treatment of Guinea Worm Disease.

The treatment of the sick patients was initially a frustrating experience. One had little to offer than the crude traditional method of extracting the worm by twisting it slowly around a stick being careful not to break the worm as this would provoke a severe local reaction. We learnt a few tricks like soaking the limb in ice-cold water to relax the worm and to facilitate its extraction. We could dress the wounds, lance the abscesses and treat secondary infections with antibiotics but there was no drug which had a direct effect on the worms or which could affect the course of the infection.

Our studies confirmed the value of two drugs - niridazole and metronidazole in relieving the symptoms and signs of the disease and accelerating the healing of the ulcers. In spite of these advances the clinical management of individual cases remains crude, cumbersome and costly. Although these drugs provide the sick patient with welcome relief, the treatment of infected patients contributes little to the control of the disease in the community.

The Impact of Protected Water Supplies

The best news about guinea worm disease is that it can be reliably controlled by protecting the drinking water. The life cycle of the worm depends on people drinking water that has been heavily contaminated from the infected sores of other patients. The best preventive measure is to ensure that drinking water is protected from such gross contamination - protected wells, bore hole and tube wells, any method of keeping drinking water free of the contamination by infected persons. Alternatively, suspect water can be treated by filtration through cloth or through sand, or by boiling the water. Although the secondary treatment of polluted water can be highly effective, it requires a high degree of compliance by the community and is best used for dealing with a short term emergency.

It is most pleasing to see villages that had been repeatedly ravaged by guinea worm diseases relieved of this scourge by the construction of a protected well. In my experience, communities thus relieved are often more ready to adopt other modern health measures: they are impressed, grateful and more likely to collaborate with other health programs. Certainly until the repeated epidemics of guinea worm disease are controlled, it is difficult to retain the sustained interest of the community in any other community projects. During the epidemic season, the issue of guinea worm dominates the life of the community distracting them from serious considerations of other questions.

IMPLICATIONS

It has been estimated that about 2.5 million cases of guinea worm occur in Nigeria each year. Clear evidence has been gathered to show the widespread occurrence of the disease in the country. A national program for the control of guinea worm disease has been launched. The strategy is logically based on improved water supplies. At the first National Conference on Dracunculiasis which was held in March 1985, the participants concluded:-

(a) "That dracunculiasis is a serious national public health problem in Nigeria, with adverse effects on health (increased pain, suffering and disability), agricultural output and a school attendance;

(b) Infection can be prevented in the long term through the provision of safe drinking water;

(c) Appropriate action is needed at the federal,state and local government levels, as well as the community level, in support of primary health care and making maximum use of the International Drinking Water Supply and Sanitation Decade; and

(d) The health, agricultural, educational and other benefits to be expected as well as the short time(less than 6 years) remaining in the Decade, justify an intensive effort over the next several years to eradicate dracunculiasis."

This initiative is a most encouraging development especially as it is part of a global effort to eradicate this infection. The conquest of guinea worm disease is worthwhile as a specific goal but the program is particularly attractive because the provision of safe water yields benefits beyond the reduction of guinea worm disease. It would also suppress the transmission of some of the other water borne infections including diarrheal diseases. Even though some of these other infections do not respond as dramatically as guinea worm disease to improvements in water supply, there will be some significant gains.

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Response to Question for Adetokunbo O. Lucas

question submitted by hon. tony p. hall

Question. Does the Carnegie Foundation currently have any involvement in programs and activities to eradicate Guinea worm disease, or are you aware of any planned involvement in this regard?

Answer. Carnegie Corporation supported the World Health Organization's African regional office-sponsored conference on dracunculiasis in Africa held in Niamey, Niger, from July 1 through 3, 1986, but the current program on strengthening human resources in developing countries plans no further or major involvement with the disease.

Prepared Statement of President Jimmy Carter, Former President of the United States

[Alfred North Whitehead, "Science and the Modern World," 1925]

"Familiar things happen, and mankind does not bother about them. It requires a very unusual mind to undertake the analysis of the obvious."

As Alfred Whitehead so aptly pointed out, we sometimes overlook lesser, but important opportunities for making significant progress. Such is the case today with the disease called Guinea worm, or dracunculiasis.

Guinea worm (dracunculiasis) takes a tremendous toll on its victims. Over 100 million persons in rural Africa, India and Pakistan are at risk of this disease which cripples up to half or more of the farmers for weeks or months during their crucial planting season, causing loss to their agriculture as well as damage to their health. An estimated 10 million cases occur annually. A 1982 World Bank report calculated that the annual losses in marketable goods from dracunculiasis were between $300 million and $1 billion per year. Millions of school days are also lost because affected students often cannot walk to school. It is impossible to quantify the amount of human suffering that results.

Victims of Guinea worm are infected by drinking microscopic larvae in water taken from contaminated ponds or other stagnant sources. The farmers and children are crippled by pain, swelling and secondary infection caused by the 2-3 feet long adult worms, which slowly emerge through the skin of the unfortunate villagers. Although most of the worms emerge on the feet or legs, some do so through the skin of the head, chest, arm, scrotum, or elsewhere.

Though specific drug therapy is not available, the infection can be entirely prevented by drilling wells to provide clean water, by simple temporary chemical treatment of stagnant ponds used as sources of drinking water, or by teaching villagers to boil their drinking water (if they have fuel) or filter it through a mesh cloth.

Surprisingly few people are aware of this dreadful disease, yet several recent international initiatives have helped bring Guinea worm to the world's attention. The International Drinking Water Supply and Sanitation Decade (1981-1990) presents a great opportunity to eradicate this scourge by providing safe drinking water to affected villages. The number of villages, worldwide, which are affected by Guinea worm are a small fraction of the total unserved population, and are usually found in the most remote, most underserved regions. The eradication of Guinea worm could come very quickly if efforts were targeted towards affected villages.

Last May, the World Health Assembly adopted a resolution calling for the elimination of dracunculiasis. This was the first such resolution since the highly successful Smallpox Eradication Program, and has done much to spur international interest in Guinea worm.

More recently, in July 1986, a multi-national meeting of affected African countries was held in Niamey, Niger, to assess the current efforts to control Guinea worm, and to coordinate national plans for Guinea worm eradication.

Since I became aware of the problem of Guinea worm, I have made the World Health Assembly's goal of eliminating Guinea worm part of my personal agenda. I have been amazed at the remarkable response we have had from countries suffering from Guinea worm. A brief summary of our recent activities should make the point that, once given the known facts of the disease, governments are eager to act.

For example, a trip I made to Pakistan in November 1986 resulted in both President Zia and the Prime Minister of Pakistan endorsing an initiative to eliminate dracunculiasis from their country. Until recently, there was very little awareness of the extent and significance of the disease in Pakistan. I personally visited an area

where only two cases had been officially reported during the previous year, while in reality some 1,200 cases had been treated by a single health care worker.

Since my initial trip to Pakistan, the President and Prime Minister of Pakistan and I agreed to begin a collaborative effort, through the Global 2000 project of The Carter Presidential Center, to combat dracunculiasis in Pakistan. A national plan of action has been established, and Pakistan is now starting pilot control projects in two different areas of the country. Pakistan will soon have a national meeting on Guinea worm eradication which will launch the eradication program throughout the country.

Ghana is another country where remarkable interest is being shown. Two weeks ago, a Global 2000 consultant returned from a trip to that country. The government of Ghana is committed to addressing the problems posed by dracunculiasis. A national plan of action will be formulated during the coming months, with a national meeting planned for early July 1987. Further, Ghana has agreed to host the second African Regional Meeting on Guinea Worm Eradication in March 1988, which will build upon the regional plans for coordination developed last year in Niamey.

Several other African countries have approached The Carter Center, all of which are eager to remove this scourge from the lives of their people. If possible, we will expand our efforts to a few other countries.

The support given to these countries is through the Global 2000 project of The Carter Presidential Center in Atlanta. Funding for Global 2000, which is premised on the belief that concerted action by governments and private individuals can help alleviate human suffering, is provided by private donations. Global 2000's contribution to national programs is small—we provide only "seed" money and expertise. The vast majority of funds for the national Guinea worm eradication programs will come from the country's own resources supplemented by bilateral and international funds.

Clearly, a strong desire exists in affected countries to eliminate Guinea worm. Accelerated action is urgently needed to achieve that goal. The momentum is building, and there is an urgent need to press ahead now. Although developing nations are willing to commit their own resources, they cannot eradicate Guinea worm alone.

As a former farmer myself, it gives me immense satisfaction to help lift the burden of this terrible disease from others. Surely every farmer in America will understand the devastating effect such a crippling disease has on a family, a region, and an entire nation's economic and physical well-being. And as members of a Congressional committee focusing on hunger, I am sure you appreciate the immense impact such a loss of agricultural productivity has on a nation's food production, nutritional status, food security, and long-term development.

By mobilizing affected farmers and their families to eliminate this highly visible problem, to which they themselves give high priority, we can start a catalytic grass roots initiative which rapidly improves living conditions, enhances villagers' self-reliance, and thereby stimulates more development. A modest effort by international development agencies in this area could make a big difference. I encourage the Select Committee on Hunger to do all it can to make the eradication of Guinea worm a reality.

Responses to Questions for William Foege, M.D.

Questions submitted by Tony P. Hall

Question. Does President Carter envision the complete eradication of Guinea worm disease? Is he convinced this is an achievable goal?

Answer. President Carter does envision this to be an achievable goal. He understands that even elimination of Guinea worm from some countries or from a particular geographic area would be beneficial, but the real goal is to eliminate this from the entire world. The experiences in India with a reduction of the intensity of the disease and at the same time a reduction in the geographic area involved provides both hope and confidence that there are not technical or scientific barriers to Guinea worm eradication. Indeed, the barriers to Guinea worm eradication appear to involve resources, commitment, and management of the resources and technical knowledge base.

Question. Could you discuss the additional benefits to be realized by the Guinea worm eradication campaign, such as reductions in or elimination of other diseases which would result from the efforts to control Guinea worm disease itself. I believe the cost of eradication programs would achieve several desirable objectives. Could you comment?

Answer. Additional benefits to be realized by the Guinea worm eradication campaign are many. I will mention three. First, where safe water supplies are installed, not only will Guinea worm be eradicated, but other water-borne diseases will also be eliminated and the quality of life for people who have readily accessible safe water will be markedly improved. Second, there is every reason to believe that agricultural production will be improved if people are not incapacitated during the planting or harvest period. This in turn will have positive health benefits because of spiraling problems caused by both malnutrition and infectious diseases. Third, an improved quality of life can be envisioned both because one form of suffering is removed but also because of the positive effects of people taking charge of their own destiny. This will be one step in removing the bonds of fatalism.

Question. In President Carter's statement, he made reference to mobilizing farmers and their families in a grassroots initiative. Yet, it seems that much of the contact has been with high level government officials. Is there anything in the national plans and strategies which are being developed by the national governments which give priority and incentives for the development of these necessary grassroots initiatives?

Answer. Contacts and commitments from the highest level of government are essential in order to develop a national plan for Guinea worm eradication. However, in Pakistan, in Ghana, and in other countries in which we will work, the program quickly gets to state, provincial, and then to local levels. At the local level decisions have to be made on the possibility of safe water supplies. If not possible, agreement must be reached on local participation in the chemical treatment of water supplies. In addition, the involvement of all people in health education, the filtering or boiling of water supplies and the treatment of Guinea worm lesions is an important part of the current and future projects.

Question. In view of the $1 billion annual cost of Guinea worm disease—per World Bank estimates—if governments and international organizations spent whatever it takes to eliminate Guinea worm disease, would we not soon recoup the investment by the overall improvement in health, school attendance, food production and so on?

Answer. For any particular country or geographic area, a return on invested capital could be expected within 1 to 2 years. Even the most expensive program which would rely primarily on introducing new and safe water supplies would realize a complete return of investment within a few years. One of the compelling arguments for Guinea worm eradication concerns the financial implication of a small investment now returning future benefits to all succeeding generations. Guinea worm eradication could have a benefit: cost ratio second only to smallpox.

Question. What has been the U.S. Government's involvement in the Guinea worm eradication campaign?

Answer. The U.S. Government through the Guinea worm collaborating center, located at the Centers for Disease Control, of the Public Health Service, has been a prime mover in alerting the world to both the cost and possibility of eradicating Guinea worm. The United States through its support of the water decade and through U.S. A.I.D. has also provided benefits to Guinea worm eradication. However, it is clear the United States could be doing more and could provide decisive leadership in making this milestone a reality.

Prepared Statement of Donald R. Hopkins, M.D., Deputy Director, Centers for Disease Control (CDC), Public Health Service, U.S. Department of Health and Human Services

My name is Donald Hopkins. I am Deputy Director of the Centers for Disease Control (CDC), and Director of the WHO Collaborating Center for Research, Training and Control of Dracunculiasis, which is located at CDC. I am also a member of the American Society of Tropical Medicine and Hygiene, which is about to receive a report it requested from the Institute of Medicine on the U.S. capacity to address tropical infectious diseases such as the one we are here to discuss today. That report will be available the end of this month.*

I would like to congratulate and thank the Chairman and the Select Committee on Hunger for holding this hearing on dracunculiasis. The mere news of this impending hearing has already helped direct more attention to the problem.

Guinea worm disease (dracunculiasis) has been ignored for too long. That neglect has allowed continuance of an important preventable impediment to health, agriculture, and education in 21 affected countries, where over 100 million persons are at risk. That neglect also represents a missed opportunity for earlier leadership on this issue. This disease cannot only be prevented; it can be eradicated by providing safe drinking water, by health education, or by vector control.

In this testimony, I shall address three points:

- o The extent and burden of dracunculiasis.
- o The efficacy of existing prevention efforts.
- o Actions needed to eradicate this disease.

*Copies may be obtained from BOSTID Reports Distribution, JH-212, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418

THE EXTENT AND BURDEN OF DRACUNCULIASIS

Guinea worm disease is manifest by 2-3 foot long worms slowly emerging through the skin, beginning about 1 year after victims drink contaminated water. In addition to the horrible appearance of this affliction, the open sore and secondary infections usually associated with the emerging worm are extremely painful. The consequent burden falls on the affected individual, family, community, and the nation.

The individuals affected are temporarily crippled. In one study the average period of such crippling was 5 weeks, in another study it was 100 days. One of every 200 victims is permanently crippled. Some die of secondary tetanus. In an outbreak reported in Nigeria last month, 6 out of 400 infected students died.

Families are affected because the disease attacks working adults as well as pre-school and school aged children. Even if the children, who usually share the same drinking water, escape infection themselves, they may have to miss school in order to replace a crippled parent on the family farm.

Communities are affected because guinea worm is a seasonal disease occurring at the time of year when demands for agricultural labor are highest: during the planting or harvest season, depending on the area. In many African communities, up to 30, 40, 60% or more of the villagers are stricken at the same time, when they can least afford it. Absenteeism from school can exceed 50% for several weeks. Although the impact of such circumstances on the nutrition of persons in affected communities has not been well documented, we can be sure that it is substantial.

Effects on the countries concerned can be imagined. Dr. John Paul and his colleagues at the Research Triangle Institute in North Carolina estimate that in Burkina Faso, the annual losses from guinea worm amount to 5.3% of the agricultural gross domestic product. Dr. Fred Galloday, an economist at the World Bank, estimated in 1982 that the global losses of marketable goods due to this disease amounted to between $300 million and $1 billion.

No one knows how many people still suffer from guinea worm disease. My best estimate is 5-15 million persons each year. In most countries only one percent or less of the victims are reported, since health posts are scarce in the rural areas concerned, the victims are crippled, and no effective drugs exist to cure the disease. In Togo, the Ministry of Public Health estimated there were over 440,000 cases in that country in 1982, although only 2592 cases were officially reported. Nigeria alone has an estimated 2.5 million cases annually. Dr. Susan Watts, a British medical geographer, estimates that more than 120 million persons are at risk of dracunculiasis in Africa, and another 20 million are at risk in India and Pakistan.

PREVENTIVE MEASURES

In addition to improving surveillance to better understand the extent and location of affected persons and initiate appropriate control measures, dracunculiasis can be prevented by providing safe drinking water, by educating persons at risk, or by chemically treating contaminated drinking water.

Water Supply. When safe drinking water was provided to a Nigerian town of about 30,000 persons in the 1960's, the incidence of dracunculiasis fell from over 60% to zero within two years. More recently the Nigerian village of Kankan, whose desperate state was brought to light by newspaper reports in 1984, eliminated guinea worm altogether within one year after the state government and UNICEF provided wells for drinking water. In Togo a missionary group helped mobilize a village of 3000 persons to contribute towards construction of local wells, and thereby reduced dracunculiasis from 928 cases in 1981 to 7 cases in 1985. Providing safe drinking water is expensive, but it also yields other benefits besides eliminating guinea worm disease.

Dr. John Paul and colleagues estimated the cost of this intervention at $0.05 per person served, with a positive cost-benefit ratio of 2.46.

Health Education. Affected villagers need to understand they can prevent this infection by persuading persons with emerging worms or blisters not to enter a pond or step well which is used as a source of drinking water. And although fuel for boiling drinking water is scarce or too expensive in many areas, the small water fleas (cyclops) containing the infective larvae can be eliminated by filtering the water through a cloth, or through a monofilament nylon material recently developed for that purpose. In Burkina Faso, Dr. T.R. Guiguemde used health education alone to reduce prevalence from 24% to 3.5% in one village, and from 54% to 8.4% in another village, in one year. Akpovi and his colleagues in Nigeria also demonstrated the ability of health education to reduce transmission in endemic villages by over 80% within 1 or 2 years.

Dr. John Paul and colleagues estimated the cost of this intervention at $2.82 per person served, with a positive cost-benefit ratio of 4.68.

Vector Control. Chemical treatment of ponds or step wells with temephos (Abate), a pesticide, kills the cyclops which harbor the infective stage of the parasite. Applied at the recommended concentration of 1 part per million at 4 to 6 week intervals during the transmission season, this chemical is safe for humans, fish, and plants in the water, colorless, tasteless and odorless. In India, this has been used to achieve a 97% reduction in incidence of dracunculiasis within one year in a village of 3700 persons. In Mali, a recent primary health care project among the Dogon used temephos to reduce dracunculiasis by 87% in one year.

Dr. John Paul and colleagues estimated the cost of this intervention at $3.95 per person served, with a positive cost-benefit ratio of 3.89.

The United Nations' Water and Sanitation Decade (1981-1990) presents a special opportunity to attack this disease. India, which began a national guinea worm eradication program in 1980, has already eliminated the disease from Tamil Nadu State, and reduced the annual incidence in the 6 remaining endemic states by 35% between 1983 and 1985. Ivory Coast, which reported over 67,000 cases in 1966, reduced the disease to less than 4,000 cases in 1985, by means of an extensive program of rural water supply and health education. Iran eliminated dracunculiasis in the 1970's; the Soviet Union in the 1930's.

ACTION TO ERADICATE DRACUNCULIASIS

Last May, the World Health Assembly unanimously adopted a resolution which was co-sponsored by the United States and six endemic countries (Burkina Faso, Cameroon, India, Mauritania, Nigeria, Uganda) calling for the elimination of dracunculiasis. This is the first such resolution since the successful Smallpox Eradication Program began in 1966.

In July 1986, the Carnegie Corporation of New York, WHO, USAID, and the USA for Africa Foundation sponsored a meeting in Niamey, Niger which was attended by representatives of nearly all affected African countries. Since then, the Global 2000 Project of the Carter Presidential Center has agreed to help mount national programs to eliminate dracunculiasis in Pakistan and Ghana. Nigeria held its first national workshop on dracunculiasis in March 1985. Ghana, Pakistan and Togo are each planning national meetings this Spring, and Ghana has agreed to host the second African regional meeting on dracunculiasis in Accra in March 1988.

It is probably too late to hope to eradicate guinea worm disease completely by the time the Water and Sanitation Decade ends in December 1990. It certainly can be eradicated by 1995, if, as a result of this hearing or other efforts, more assistance, leadership and encouragement are manifest soon in the affected countries and in international development agencies.

By the end of 1987, every country where this disease is a significant public health problem needs to have developed a national plan of action describing how they intend to address this problem. Ten countries have such plans already, or are developing them. In Asia, the two major endemic countries - India and Pakistan - are already fully mobilized. In Africa, the "core" endemic countries now include Senegal, Mauritania, Mali, Niger, Nigeria, Benin, Togo, Ghana, Burkina Faso, Uganda, Sudan, and Ethiopia. Seven of those 12 African countries have national plans of action or are developing them. All need help of varying degrees.

If the major western bilateral development agencies, the four United Nation agencies concerned (WHO, UNDP, UNICEF, World Bank), and the various private voluntary organizations did nothing more than to ensure that every primary health care, health education, community assistance, rural development, agriculture development, primary or secondary education, drinking water supply, water resources development, and health worker training project they assist in affected rural areas include a "guinea worm component", and the national governments concerned did the same, that in itself could quickly reduce this disease to very low levels. Because less than 10 percent of the villages without safe drinking water in the endemic countries have guinea worm disease, this is a manageable public health problem. In exchange for marginal additional cost, if any, the projects concerned would gain an important, visible, measurable, impact - improvement of health, education, and agriculture - which would be a powerful additional incentive for country/community participation, and provide obvious political benefits for the sponsors.

It is not by accident that in Africa guinea worm disease is found in the same belt of Sub-Saharan countries where the recent drought and famine were most severe. Both catastrophes result from scarce water. Eradicating guinea worm disease is one specific improvement which should be sought now, as an important part of Africa's Priority Program for Economic Recovery (APPER).

This is the only infectious disease which is only transmitted by drinking contaminated water. We know how to eradicate it. No one should continue to suffer this affliction. That some still do, diminishes us. As Dr. Myron Schultz, Chairman of the National Research Council's 1982 Workshop on Opportunities to Control Dracunculiasis wrote:

> In every age, our concept of health grows broader. In every age, we uncover a formerly unrecognized form of oppression that can be prevented. Now is the time to dedicate our energies toward the liberation of mankind from the suffering caused by dracunculiasis...

RESPONSES TO QUESTIONS FOR DONALD R. HOPKINS, M.D.

QUESTIONS SUBMITTED BY HON. TONY P. HALL

Question. What interest have the other donor governments taken in the campaign to eradicate Guinea worm disease? Is there a need for stronger U.S. Government leadership on this front?

Answer. Other governments which have assisted the global campaign to eradicate dracunculiasis are:

Canada. The International Development Research Center (IDRC) is supporting a 3-year research project at the University of Benin, in Togo, to study the impact of providing safe water to an endemic area of 60,000 persons.

Denmark. The Danish Aid Agency, DANIDA, is supporting a water supply project in Madhya Pradesh, India as a part of that country's Guinea worm eradication program. DANIDA is also funding a project to help control dracunculiasis and schistosomiasis in a district in northern Ghana.

France. ORSTOM, the French assistance agency, provided an epidemiologist to work full-time on dracunculiasis in Benin, beginning in 1985.

Japan. In March 1987, the Japanese government agreed to provide $5.5 million as a grant-in-aid to the government of Anambra State, Nigeria to assist that state's vigorous dracunculiasis elimination program. The funds will be used to provide safe water supplies to affected villages.

Sweden. SIDA, the Swedish international assistance agency, is providing funds to support provision of safe drinking water to villages in two heavily endemic districts of Rajasthan State, India, as part of that country's Guinea worm eradication program.

In addition, UNICEF is assisting antidracunculiasis efforts in India, Nigeria, Sudan, Togo, and Uganda. Yes, there is need for stronger U.S. Government leadership on this front, both for its inherent direct assistance and as an example for other governments.

Question. Could you list the benefits to be realized, in human terms, from the eradication of Guinea worm disease? The impact on malnutrition is of particular interest.

Answer. The benefits of eradicating Guinea worm disease include reduced human increased agricultural production. Restoring 30 to 40 percent or more of adults to the workforce at planting or harvest time, especially women, must improve local nutrition, although the impact of such efforts have not been quantified. It is estimated that over 5 percent of the total gross agricultural product of Burkina Faso is believed to be lost because of the effects of dracunculiasis.

Question. Is it correct that we already have all of the technology needed to control and then eliminate Guinea worm disease and that nothing new or expensive needs to be designed? Is it correct that control and elimination of Guinea worm disease can be accomplished by applying fairly low-level technology and relatively simple measures?

Answer. Yes. Yes, the necessary technology is already known and simple: people should not enter a source of drinking water if ill; they should filter or bottle their water; or contaminated water can be chemically treated if safe drinking water cannot be provided within the short term.

Question. Could already existing or planned water projects in endemic areas have a Guinea worm disease component added to them? Wouldn't this be a way to reduce the cost of attacking Guinea worm disease?

Answer. Absolutely. Doing so would also increase the benefits of such projects, which should give priority to providing safe drinking water for areas where Guinea worm exists.

Question. The nature of the Guinea worm eradication campaign cuts across several sectoral lines. Would it not make sense to incorporate a Guinea worm disease component in primary health care, health education, rural development, agricultural development, and education projects in the affected areas?

Answer. Absolutely, for the same reasons as given in response to question No. 4.

Question. To what extent is Guinea worm disease eradication another initiative which may not be successful unless women are integrated in the planning, design, and implementation of projects and activities? That is, women haul most of the household water in many of these regions. They suffer from the disease, they see the impact on the families. Do we not have to integrate women in the strategies to eliminate this disease?

Answer. Because women and girls gather most water for household use, they are doubly important in efforts to eradicate the disease. They are a key untapped resource for eliminating Guinea worm.

Question. Although the knowledge of Guinea worm disease has increased in recent years, there are still a lot of unknowns. It would seem there are areas where a lack of knowledge is impeding efforts to eradicate this disease. In many countries I understand the numbers of people stricken is hard to determine. Might the effects of the disease be even worse than we think?

Answer. It is quite possible that as surveillance improves, even more persons may be found to be suffering from dracunculiasis than the current estimate of 5 to 15 million. At present, we believe only 1 to 5 percent or less of cases are officially reported.

Question. Do you have any doubts that the eradication of Guinea worm disease is an achievable goal? Can it be done?

Answer. I have no doubts that Guinea worm can be eradicated. It already has been eliminated from several countries and incidence is declining in some other areas where vigorous programs have been implemented. There is no animal reservoir from which the parasite can return once the infection is eliminated in humans.

Question. Would it be of particular value for our AID missions in Guinea worm disease-endemic countries to support better surveillance and reporting of the disease? Is that a priority need?

Answer. Support for improved surveillance is a priority need. It would be especially valuable if AID missions would help support better surveillance and reporting of this disease; in so doing the general surveillance systems in affected countries can be invigorated.

Prepared Statement of Kenneth J. Bart, M.D., Agency Director for Health, Bureau for Science and Technology, U.S. Agency for International Development [A.I.D.]

Thank you for inviting the Agency for International Development to appear before this Select Committee to discuss our efforts to control Dracunculiasis or guinea worm disease.

Guinea worm disease is one of a long list of debilitating and sometimes life-threatening diseases related to water and sanitation. These range from waterborne diseases, such as diarrhea, hepatitis, and typhoid, to water-washed diseases, such as conjunctivitis, scabies, trachoma, and typhus, to water-based maladies, such as schistosomiasis. Others -- malaria, dengue, yellow fever, and onchocerciasis -- are transmitted by insects which breed in or near water. Where clean water is available in sufficient quantities, most of these diseases can be prevented or at least limited.

Though it is not life-threatening, guinea worm disease, which falls into the waterborne category, is severely incapacitating.

A.I.D. WATER SUPPLY AND SANITATION ACTIVITIES

In the late 1970's a resurgence of interest in water-supply and sanitation in developing countries culminated in the United Nations Decade for Drinking Water Supply and Sanitation. Since the outset of the "water decade" in 1981, A.I.D. has supported water supply and sanitation projects in 41 countries and in five regions. These are listed in Table 1. The total amount of funding to date for this effort is $1.94 billion.

These projects range from rural water supply projects to primary health care projects with water components, to projects focusing on water-related disease control. The $1.94 billion represents A.I.D. obligations from development assistance and economic support fund accounts. The costs shown do not include host country contributions (which are substantial), PL-480 financing (which is significant in Africa), Housing Investment Guaranty funding of the water and sanitation components of housing and urban development projects, or disaster assistance.

ACTIVITIES IN GUINEA WORM DISEASE INFECTED COUNTRIES

From 1980 to the present, $72.5 million has been obligated or is planned for water and sanitation activities in 10 guinea worm disease infected countries. These are shown in Table 2. While many of these projects are not specifically aimed at guinea worm disease, experience tells us that we can expect some diminution of the disease as a result of these activities.

In addition to bilateral water and sanitation projects in guinea worm infected countries, A.I.D. provides a variety of practical assistance to organizations involved in guinea worm disease control projects, which I will highlight briefly below.

INFORMATION NETWORK

The first of these related activities is a guinea worm information network. This network has just recently been established to work closely with the World Health Organization, the Centers for Disease Control, and other international and national organizations. Specifically it includes (1) a data base of A.I.D. and non-A.I.D. projects with guinea worm disease control potential, (2) another data base of key individuals, consultants, and specialists who are actively involved in and knowledgeable about the disease, (3) a collection of guinea worm publications with an accompanying bibliography, (4) health education materials, such as films and tapes, and (5) guidelines for developing add-on guinea worm projects.

HEALTH EDUCATION

Another related activity concerns health education. For water supply and sanitation projects to truly benefit the people they are designed to serve, and to have an impact on their health, the "hardware" (water supply technologies) must be integrated with the "software" (community participation and health education).

Because of its mode of transmission, guinea worm disease can be addressed through health education. A.I.D. is developing specific guidelines for guinea worm education. These guidelines are intended for the front line community workers, i.e., development and extension agents from ministries of agriculture, interior, or rural development as well as ministry of health personnel from nurses down to village health workers. These guidelines address four issues. The first concerns early identification. How can people recognize guinea worm disease? How serious is it and how serious can it become? The second concerns causes of transmission. Where do people get the disease? Can they spread it to others? Here knowledge of migrations and population movements as well as the transmission cycle of the larvae is explained. The third section concerns care of those infected with the disease, and the final section covers prevention: filtering or chemical treatment of water; protecting water sources; and informing people moving into the community about the dangers of guinea worm disease and how it can be prevented.

SUPPORT OF PVOs

In recent years A.I.D. has made a strong commitment to support private voluntary organizations (PVOs), especially in Africa. Most of the major PVOs have some water/sanitation or health education projects in guinea worm infected countries. For example, World Vision carries out projects in Senegal, Mali, and Ghana; CARE works in Cameroon, India, Mali, and Chad; Save the Children has a project in Burkina Faso.

A World Neighbors project in Togo shows what can be achieved. Starting in 1981, the project used health education to mobilize a village of about 3,000 inhabitants in which 928 cases of guinea worm disease were reported in that year. Starting in 1983, the population helped construct local wells and by 1985, the incidence of guinea worm disease had been reduced to only seven cases.

In 1986, A.I.D. undertook an in-depth study of the effectiveness of PVOs in the water/sanitation sector. The study concluded that PVO programs had considerable strength at the local and community level, but that many PVOs lacked technical expertise in the sector. Consequently A.I.D. has given high priority to providing some of the much needed technical assistance to PVOs working in the water and sanitation arena.

A.I.D. is about to sign a $2.2 million matching grant agreement with World Vision to help strengthen that organization's ability to plan, design, and implement water and sanitation projects in Africa. A.I.D. has also supported a number of project design and technical training workshops for PVO staff in the last three years, and there are a number of other workshops and short-term technical assistance efforts for PVOs planned for this year.

COLLABORATION WITH PEACE CORPS

Over recent years, the directors of A.I.D. and the Peace Corps have made a strong commitment to improve the coordination of our two agencies and to work more closely together at all levels. A.I.D. has provided technical assistance to the in-service training programs in various Peace Corps

countries and to the PC/Washington Office of Training and Program Support. A.I.D. has also supported volunteer and staff conferences. The highly successful Special Projects Assistance (SPA) program which provides A.I.D. funds to Peace Corps for volunteer projects is another example of collaboration. It is estimated that over a third of the Office of Health SPA projects are in support of improved village water and sanitation facilities.

The Peace Corps has volunteers in most of the guinea worm infected countries in Africa, and many of these volunteers are working in health, community development, or water projects. The skills and ideas of volunteers and former volunteers have contributed greatly to the success of the A.I.D.-funded Togo Rural Water Supply project. Volunteers are working or have worked on A.I.D. water/sanitation projects in Burkina Faso, Chad, Cameroon, Togo, and Benin. A.I.D. is planning to provide assistance to Peace Corps in Senegal for a technical in-service training workshop on surface well improvements and in Benin for a project start-up workshop. In addition, A.I.D. is helping the Peace Corps to develop guinea worm health education materials and guidelines for strengthening the water/sanitation projects of the Peace Corps.

WELL REHABILITATION

Rehabilitation of existing water sources is critical to the control of guinea worm disease, since hand dug wells are one of the most common traditional sources of water in many guinea worm infected countries. And it is unsanitary conditions around many of these wells that contribute to the cycle of guinea worm infestation of the water. To respond to this problem,

A.I.D. has developed a two-week workshop for health extension agents, including Peace Corps volunteers, to teach them how to improve the conditions of dug wells. The workshop covers simple low cost improvements to prevent people from standing in the water and to prevent the surplus water from draining back into the well. The workshop also covers user education strategies on proper water handling and storage. Later this year, the training guide will be piloted in Senegal with Peace Corps volunteers and World Vision staff.

TECHNICAL AND SCIENTIFIC ACTIVITIES

In planning water and sanitation projects in guinea worm infected countries a number of technical issues come into play. More needs to be known about the role of water and sanitation activities in the control of guinea worm, and there is a need to collect accurate information on the distribution of the disease and to monitor methods of control now being used.

In Cameroon and Burkina Faso, A.I.D. and CDC recently completed national epidemiological guinea worm disease surveys. Each includes a national action plan for control of the disease. As a result of these activities, basic methodologies for conducting cost-effective surveys and evaluation techniques have been developed and are available for use wherever guinea worm remains a major public health problem.

In recent years, there has been considerable expansion of the literature concerning guinea worm disease -- including studies on the epidemiological and geographic nature of the disease, successful control projects and the measures employed, advances in chemical control of the vectors, and studies underway to find a chemotherapeutic means of control. A.I.D. is prepared to share this information with other interested agencies so that they too will have rapid access to the most current advances in effective and economic control of the disease.

A.I.D.'s TWO-PRONGED APPROACH FOR THE FUTURE

Now, I would like to turn from the description of A.I.D. activities to a brief discussion of what more A.I.D. intends to do to decrease the incidence of guinea worm disease. Our approach at A.I.D. is two-pronged. First, from our own quick survey, we know of at least 80 water and sanitation projects in guinea worm infected countries funded by a variety of PVOs and international organizations. Wherever there are on-going water and sanitation projects — whether funded by A.I.D. or others — we are prepared to provide technical assistance to improve the impact of those programs on the control of guinea worm disease. Second, A.I.D. stands ready to help with surveillance of existing control projects, epidemiological mapping of the disease, and technical support for countries to develop national plans for the control of guinea worm disease.

How could existing programs be enhanced? There are many opportunities. For those water and sanitation projects without a guinea worm disease control component, one could be added. Information on the disease, health education materials, and guidelines on how to add a guinea worm disease component are all available. To enhance current guinea worm disease projects, hygiene education workshops for health workers in the field are needed. Rehabilitating and improving existing water sources and constructing new sources will also be considered.

Finally, A.I.D. stands ready to provide assistance in social marketing for control of guinea worm disease for interested countries. Social marketing uses the radio, printed materials, and person-to-person contacts, to encourage the simple modifications in behavior that can prevent guinea worm disease.

In conclusion, let me note that A.I.D. has long been concerned about the heavy toll that inadequate water and sanitation takes on the health of citizens of the developing world. We are pleased at the attention this Committee has directed at this important health problem, and we look forward to close cooperation with WHO, CDC, the PVO community and national governments to improve control of guinea worm disease.

Table 1

WATER AND SANITATION ACTIVITIES: TOTAL FUNDING 85/06/07

COUNTRY	TITLE	PROJ#	BEG	WSS%	TOTAL	REG
Benin	Rural Water Supply	6800201	80	100.0	13414	AF
Burkina Faso	Rural Water Supply	6860228	79	100.0	13480	AF
Burundi	Community Water and Sanitation	6950189	83	100.0	336	AF
Cameroon	Northern Wells Phase II	6310051	84	75.0	615	AF
Chad	Rural Sanitation and Water	6770022	78	.0	0	AF
Kenya	PVO Co-Financing	6150236	85	.0	0	AF
Lesotho	Rural Water and Sanitation	6320088	79	96.0	11656	AF
Liberia	Primary Health Care Project	6690165	83	5.0	0	AF
Liberia	Primary Health Care Project	6690165	83	5.0	735	AF
Malawi	Rural Piped Water	6120207	80	90.0	5400	AF
Malawi	Health Institutions Development	6120211	84	3.0	148	AF
Malawi	Lower Shire Valley Intervention	9380501	85	15.0	0	AF
Regional	Health Institutions Improvement (1220)	6980412	78	.0	0	AF
Sahel Regional	Water and San.Problems in Sub-Sahara	9365955	85	100.0	0	AF
Senegal	Rural Health Services II	6850242	84	2.0	185	AF
Senegal	WARO:86 CS Grant	9380518	86	9.0	0	AF
Somalia	Comprehensive Groundwater Dvlpt.	6490104	79	100.0	6556	AF
Sudan	Rural Health Support-OPG	6500030	80	2.0	324	AF
Sudan	Rural Health Support	6500030	80	2.0	0	AF
Sudan	GEDAREF Municipal Water Supply	6500065	83	100.0	13000	AF
Sudan	Health Constraints to Rural Production	6500073	85	5.0	106	AF
Swaziland	Rural Water-Borne Disease Control	6450087	79	.0	0	AF
Togo	Rural Water and Sanitation	6930210	80	80.0	9391	AF
Uganda	Rural Hlth.Center Proj.of Makerere U.	9380513	85	5.0	0	AF
Zaire	Basic Rural Health	6600086	81	5.0	249	AF
Zaire	Basic Rural Health II	6600107	85	5.0	820	AF
Zaire	Shaba Refugee Water Supply	6600116	85	100.0	2250	AF
Zimbabwe	Zimbabwe Supported Primary Health Care	9380505	85	22.5	0	AF
Subtotal					78659	
ANE Regional	Regional Environmental Activities	3980178	84	25.0	269	AN
Bangladesh	Urban Volunteer Program	3880073	86	20.0	400	AN
Bangladesh	Urban Volunteer Program	3880073	86	20.0	920	AN
Bangladesh	Grant to UNICEF	9380780	85	.0	0	AN
Egypt	Canal Cities Water & Sanitation	2630048	78	100.0	169000	AN
Egypt	Urban Health Delivery Systems	2630065	79	.5	228	AN
Egypt	Alexandria Sewer Expansion II	2630100	79	100.0	198700	AN
Egypt	Basic Village Services	2630161	78	85.0	476170	AN
Egypt	Cost Recovery Programs for Health	2630170	87	.0	0	AN
Egypt	Cairo Sewage II	2630173	84	100.0	368300	AN
Egypt	Canal Cities Water & Sewage II	2630174	87	100.0	360000	AN
Egypt	WRS Inst.Development	2630176	85	100.0	15000	AN
Fiji	Fiji Development Program	0820101	86	50.0	200	AN
Indonesia	Save the Children Hlth.& Survival Proj.	9380502	85	.0	0	AN
Indonesia	Child Survival Project	9380503	85	10.0	0	AN
Indonesia	CS Activities in Integrat.PHC Programs	9380518	85	5.0	0	AN
Jordan	Irbid Water and Sewage	2780233	80	100.0	23500	AN
Jordan	Zarqa-Ruseifa Water	2780234	82	100.0	15000	AN
Jordan	Water Systems and Services Mgt	2780259	83	75.0	15750	AN
Nepal	PVO Co-Financing-OPG	3670144	82	9.0	128	AN
Nepal	PVO CO-Financing-OPG	3670144	82	9.0	80	AN
Oman	Water Resources Development	2720184	86	100.0	74570	AN
Philippines	PVO Co-Financing II-OPG	4920347	84	.0	0	AN
Philippines	Rural Water Supply and Sanitation	4920401	84	100.0	25000	AN
So.Pacific Reg.	PVO Co-Financing-OPG	8790001	84	40.0	502	AN
So.Pacific Reg.	SPC Multi-Program Support	8790004	85	.0	0	AN
Sri Lanka	Malaria Control	3830043	78	10.0	3000	AN
Sri Lanka	Water Supply and Sanitation Sector	3830088	84	95.0	11685	AN
Thailand	Rural Primary Health Care Expansion	4920291	78	12.0	838	AN
Thailand	PVA Institutional Development	4920331	84	100.0	5700	AN
Tunisia	Rural Potable Water	6640337	84	100.0	6500	AN
Yemen	Small Rural Water Systems	2790044	79	100.0	21500	AN
Subtotal					1784940	

Antigua	Antigua Water Supply	5380098	83	100.0	0	LA
Belize	Program Development and Support	5050000	83	.0	0	LA
Belize	Increased Product.Through Better Health	5050018	87	53.0	3710	LA
Belize	Increased Product.Through Better Health	5050018	85	53.0	3710	LA
Belize	Village Health Sanitation-OPG	5050024	84	100.0	700	LA
Bolivia	Self-Financing Primary Health Care	5110569	83	4.5	29	LA
Bolivia	Self-Financing Primary Health Care	5110569	83	4.5	0	LA
Bolivia	Self-Financing Primary Health Care	5110569	83	4.5	0	LA
Bolivia	Self-Financing Primary Health Care	5110569	87	4.5	29	LA
Bolivia	PVO ORT and Child Growth Monitoring	5110590	85	5.0	15	LA
Bolivia	PVO ORT and Child Growth Monitoring	5110590	85	5.0	7	LA
Bolivia	PVO ORT and Child Growth Monitoring	5110590	87	5.0	15	LA
Bolivia	PVO ORT and Child Growth Monitoring	5110590	85	5.0	0	LA
Bolivia	Child Health and Rural Sanitation	5110599	86	27.0	1215	LA
Bolivia	Child Health and Rural Sanitation	5110599	86	27.0	135	LA
Bolivia	Prog.Dvlp.to Enchance Child Hlth.& Sur.	9380502	85	.0	0	LA
Bolivia	Rural Bolivia Health Education	9380503	85	.0	0	LA
Bolivia	Child Sur.Activities in PHC Programs.	9380510	85	5.0	0	LA
Dom.Republic	Program Development and Support	5170000	75	.0	0	LA
Dom.Republic	Rural Water Project	5170232	85	80.0	344	LA
E.Carib.Reg.	Immediate Health Care	5380149	86	10.0	55	LA
Ecuador	Integrated Rural Health Delivery System	5180015	87	37.2	4600	LA
Ecuador	Integrated Rural Health Delivery System	5180015	81	37.2	4600	LA
Ecuador	Strengthening Community Organization	5180033	83	20.0	31	LA
El Salvador	Hlth. and Jobs for Displaced Families-OPG	5190281	87	.0	0	LA
El Salvador	Hlth. and Jobs for Displaced Families-OPG	5190281	82	.0	0	LA
Grenada	Infrastructure Revitalization	5430008	84	100.0	6400	LA
Guatemala	Commun.Based Integrated Hlth & Nut Systems	5200251	80	90.0	9720	LA
Guatemala	Rural Potable Water & Sanitation II	5200335	85	100.0	1000	LA
Guatemala	Rural Water Project	5200336	85	100.0	500	LA
Haiti	Management of Malaria	5210143	82	5.0	0	LA
Haiti	Management of Malaria	5210143	82	5.0	0	LA
Haiti	Management of Malaria	5210143	82	5.0	400	LA
Haiti	Management of Malaria	5210143	82	5.0	0	LA
Haiti	Child Survival Prog.in Jacmel,Haiti	9380514	85	.0	0	LA
Honduras	Rural Water and Sanitation	5220166	80	100.0	20700	LA
Jamaica	Vol.Sector Development	5320085	83	2.0	11	LA
Peru	Extension of Integrated Primary Health	5270219	79	15.0	165	LA
Peru	Rural Water System/Sierra	5270221	80	.0	0	LA
Peru	Reforestation Food for Work Program	5270231	86	2.0	0	LA
Peru	Expanded Reforestation Program	5270231	86	2.0	2	LA
Peru	Reforestation Food for Work Program	5270231	86	2.0	0	LA
Peru	Caritas Feeding Program	5270248	86	2.0	3	LA
Peru	Expanded Improved Feeding Program	5270248	86	2.0	0	LA
Peru	Expanded Improved Feeding Program	5270248	84	2.0	9	LA
Peru	Expanded Improved Feeding Program	5270248	86	2.0	0	LA
Peru	Nutrition for Child Survival Program	5270297	86	10.0	4	LA
Peru	Nutrition for Child Survival Program	5270297	85	10.0	4	LA
Subtotal					58113	
FVA	CRS Matching Grant:Water	9380135	83	100.0	1200	WW
SCI	Innovative Science Research Proj.(Delbecy)	9365542	81	.0	0	WW
ST/H	HEALTHCOM	9311018	85	2.0	60	WW
ST/H	HEALTHCOM	9311018	85	2.0	300	WW
ST/H	Communication for Child Surv.HEALTHCOM	9311018	85	2.0	24	WW
ST/H	Family Health and Demographic Surveys	9363023	84	2.0	105	WW
ST/H	Water & Sanitation for Health (WASH II)	9365942	84	100.0	19700	WW
ST/H	Water and San.Problems in Sub-Sahara	9365955	85	50.0	265	WW
Subtotal					21654	
Total					1943366	

Table 2

A.I.D. WATER AND SANITATION PROJECTS
IN GUINEA WORM INFECTED COUNTRIES

COUNTRY	TITLE	BEGINNING	%WSS	FUNDING (in thousands of dollars)
BENIN	Rural Water Supply	1980	100	13,414
BURKINA FASO	Rural Water Supply	1979	100	13,480
CAMEROON	Northern Wells Phase II	1984	75	615
CHAD	Rural Sanitation & Water	1978	-	-
KENYA	PVO Co-financing	1985	-	-
SENEGAL	Rural Health Services II	1984	2	185
SENEGAL	WVRO: 86 CS Grant	1986	9	-
SUDAN	Rural Health Support - OPG	1980	2	324
SUDAN	Rural Health Support	1980	2	-
SUDAN	GEDAREF Municipal Water Supply	1983	100	13,000
SUDAN	Health Constraints to Rural Production	1985	5	106
TOGO	Rural Water & Sanitation	1980	80	9,391
UGANDA	Rural Health-Center Project of Makerere U.	1985	5	-
YEMEN	Small Rural Water Systems	1979	100	21,500
	TOTAL			72,015

RESPONSES TO QUESTIONS FOR KENNETH J. BART, M.D.

QUESTIONS SUBMITTED BY HON. TONY P. HALL

Question. Your testimony indicates that since the onset of the U.N. water decade, A.I.D. funding for water supply and sanitation projects totals almost $2 billion. Isn't it true that the overwhelming majority of these funds have been used for water projects in urban areas, even though U.N. decade efforts are targeted toward rural areas?

Answer. Yes, the majority of the funds have been spent on urban water projects; however, $1.5 billion of the $2 billion have been targeted to Egypt. In Egypt, one-third, or $476 million, has been spent on rural projects. When funds for Egypt are excluded, 50 percent of funds have been spent on rural projects, 44 percent on urban, and 6 percent on central support.

Question. What are the trends in spending for rural water projects? Are we spending more or spending less in this area, say, Africa today than we were in 1980?

Answer. Trends in spending for rural water projects in Africa have been documented only since 1975. Funding for rural water began in 1975 at a modest $0.3 million and peaked at $18.4 million in 1981. The decline in spending since 1981 is shown by the following obligations: Fiscal year 1982, $12 million; fiscal year 1983, $6.3 million; fiscal year 1984, $5.8 million; fiscal year 1985, $6.4 million; and fiscal year 1986, $1 million. Once complete program information from private voluntary organizations is received, an amount comparable to that of fiscal year 1986 is expected for fiscal year 1987.

While there is a clearly recognized need for water supply and sanitation in Africa, the actual extent of the need has not been well defined and long-term regional water resources planning is limited. Due to limited resources, and the necessity to make difficult choices, A.I.D.'s health activities in Africa have in recent years focused on child survival technologies, specifically on immunization and oral rehydration therapy, technologies which are cost-effective and have proved more sustainable than water systems in the present Africa context.

Question. How committed are we to providing rural villagers with a basic water supply as a priority? Has A.I.D. taken the initiative in any Guinea worm disease infected country to see that assistance is needed to formulate a country strategy for eradication? In what, if any, countries has this been done? In what countries could this be done? That is, where would it be appropriate and practical for A.I.D. to quickly launch an assault on Guinea worm disease? And, when might we expect an announcement on this initiative?

Answer. Water supply activities remain an important part of the Agency's rural health strategy and is part of our Africa child survival strategy; however, water supply is one of several priorities competing for limited funding.

At present A.I.D. is working toward the control of Guinea worm disease (GWD), which will be a long and expensive process. A.I.D. has supported the development of national plans of action for GWD control in Cameroon and Burkina Faso. A.I.D. has also contributed significantly to a regional GWD control meeting held in Niamey, Niger, in July 1986. A.I.D. plans to explore applied GWD field research and development of action in Pakistan, Togo, Benin, and possibly Nigeria in 1987. A.I.D. will continue to contribute to this global goal. Our way of informing/announcing A.I.D.'s plans and activities is through cables to missions, et cetera, flyers, notices to organizations, newsletters, articles, and are reflected in our yearly presentation to Congress.

Question. If the WASH Project (Water and Sanitation for Health) is the main A.I.D. channel for participating in the water decade, and if the Agency is serious about the goals of the decade, then why has funding for WASH continued to decline?

Answer. WASH is only part of the Agency's participation in the water decade. The objective of the decade is to provide people with safe drinking water and this objective is met through bilateral water projects funded also at the mission level.

Central bureau funding for WASH has been fairly constant, at approximately $2.4 million per year, with mission buy-ins and previously obligated funds providing variation from year to year.

Funding for the WASH Project

[In millions]

Year:	*Amount*
1985	$2.4
1986	2.7

1987 (OYB)	2.4
1988 (CP)	3.0

Question. Is A.I.D. prepared to make the eradication of Guinea worm disease a priority? We have heard excellent testimony concerning this horrible disease. It is obviously a major hunger/malnutrition issue. It can be eliminated. Do you see the **Agency doing what is necessary to achieve this goal?**

Answer. A.I.D. recognizes the importance of Guinea worm disease (GWD). A.I.D. stands ready to provide public health and engineering technical assistance, as appropriate, to integrate GWD control into existing water supply and sanitation projects wherever requested in affected countries. Further, A.I.D. will provide epidemiological support to assist interested countries in assessing the importance of Guinea worm as a significant problem and will assist in the development of national action plans. GWD can be eliminated but at a great cost. A.I.D. will continue to work on local control, as a step toward the long-term goal of GWD eradication.

Cost-Effective Approaches to the Control of Dracunculiasis

Written statement prepared for the hearings of the
House Select Committee on Hunger, March 17, 1987

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Water and Sanitation for Health Project

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NOTE: The following statement is a summary prepared from Technical Report No. 38 (September 1986) of the Water and Sanitation for Health (WASH) Project, sponsored by the Office of Health, Bureau of Science and Technology, U.S. Agency for International Development.

I. Overview

A recurring problem in planning programs to control guinea worm disease has been how to mount effective measures within the context of existing primary health care, water supply and sanitation, or vector control programs.

This paper, prepared as a Technical Report for the USAID-funded Water and Sanitation for Health or WASH Project, proposes activities, develops example cost estimates, and carries out a cost benefit analysis for modular strategies for the control of dracunculiasis. Although a comprehensive approach to the control of the disease is presented, it is thought that existing country projects and programs would more likely select modules, or parts of modules, that could serve as cost-effective guinea worm control adjuncts to existing programs.

[Figure 1 about here]

A. Modular Approach [Figure 2 about here]

Four modules relating to activities necessary for the control of guinea worm disease are developed in this paper, with preliminary costs estimated for each: (1) an epidemiologic surveillance module; (2) a community participation/community health education/personal prevention module; (3) a community water supply module; and (4) a chemical control module.

[Figure 3 about here]

Detailed description and costing of each module was based on data from a variety of secondary sources, specifying for each module: (1) specific objectives; (2) necessary activities; (3) key assumptions; and (4) essential cost items.

B. Cost Estimates

Cost estimates were developed for a hypothetical two year program to benefit an estimated 50,000 persons in 100 villages in a West African country.

Cost information was integrated from several different sources, all with their origin in West African projects. These sources include:

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(1) Centers for Disease Control (CDC) dracunculiasis reports on Togo, Benin, and Ivory Coast;

(2) A dracunculiasis control project proposed for Burkina Faso;

(3) Ongoing experience from a community health project in Togo, implemented by World Neighbors; and

(4) Various WASH sources and reports during the last few years.

It should be emphasized that the costs developed in this paper come from a variety of sources. They are intended to provide a conservative example of what costs might be, and to provide a template of activities for more specific and accurate costing within a particular country or region within a country.

C. Costs Chargeable to Guinea Worm

Consistent with the concept of guinea worm control being a part of overall primary health care and development strategies, assumptions were made about the portion of any particular intervention module which should be chargeable to the guinea worm program. It was felt that to the degree benefits would accrue to other health and development objectives, that portion should not be costed to guinea worm control. The modules, therefore, were estimated to have the following proportions related strictly to guinea worm control:

- For epidemiologic surveillance -- 100 percent was charged to guinea worm since, in our report, the effort would be solely focused on this disease. If it is combined with surveillance for other diseases, then this percent chargeable should be considered less.

- For community participation -- only half or 50 percent should be costed to guinea worm since community participation/community health education efforts on guinea worm will probably be combined with primary health care, oral rehydration, and other efforts;

- Benefits of community water supply projects in other areas related to disease prevention and economic productivity are felt to be at least 60 percent of the total costs; therefore guinea worm control should only be "charged" 40 percent; and finally

- For chemical control -- 100 percent of the costs should be charged to guinea worm since the effort would be solely focused on this disease.

II. Intervention Modules

I would like now to briefly describe the individual modules; their objectives, the activities and assumptions, and the estimated total costs and costs associated with guinea worm control for these activities in our hypothetical two year program serving 100 villages and benefiting approximately 50,000 people.

A. Epidemiologic Surveillance

1. Objectives

Although not a specific "intervention" in itself, epidemiologic surveillance is a necessary component for any general strategy to understand and address the problem of guinea worm disease. The general objectives considered in our report are: (1) to facilitate ongoing in-country knowledge regarding disease prevalence and distribution; (2) to improve overall recognition and reporting of the disease by local health workers and public officials; and (3) to conduct appropriate data analysis and reporting activities regarding guinea worm disease.

2. Activities

Activities for the epidemiologic surveillance module include:

(1) active surveillance over the area to be served by the project in the form of baseline and follow up surveys, both screening surveys at all villages and in-depth surveys at a subsample;

(2) liaison with health workers and other public officials, including training, public relations, and material and report form development to improve passive reporting on guinea worm disease; and

(3) data analysis and reporting.

3. Assumptions

It is assumed that moderate capacity for epidemiologic surveillance would exist in any endemic country choosing to implement a guinea worm control program, which would include, at minimum, a health reporting/health information system, a cadre of health workers to carry out the surveys, and basic transportation capability.

4. Costs

Total costs for the epidemiologic surveillance module, 100 percent of which are seen as "chargeable" to guinea worm control, are $18,650 for the program, or $187 per village.

B. Community participation/Community health education

1. Objectives

The objectives of community participation and community health education efforts are to gain community and individual understanding, involvement, and initiative for the local control of guinea worm disease. Activities at the individual level would focus largely on personal prevention, such as avoiding entering water sources when guinea worm lesions are present and filtering drinking water to remove the cyclops vector. Activities at the community level would focus on the implementation and maintenance of improved community water supplies or chemical treatment approaches to guinea worm control.

2. Activities

Specific activities related to community participation/community health education are varied and detailed, and additionally will vary depending upon the intervention technology (CWS or chemical treatment) that is decided upon. These activities include:

(1) recruiting of village-level promoters and supervisors, and paying their salaries and per diem. It is assumed that there would be one promoter per ten villages, and one supervisor per five promoters;

(2) initial and ongoing annual training in community participation and health education techniques for these individuals;

(3) technical training regarding the particular technological intervention, either CWS or chemical treatment; and

(4) health education materials and technical support, including filtering sieve materials for initiating and encouraging personal prevention activities as part of overall guinea worm control strategies.

3. Assumptions

Community participation/community health education activities are necessary for any general strategy to address the problems of guinea worm disease, or for that matter, virtually any other problem of community public health in the developing world. It is assumed that a basic health education system exists in the particular country, but that workers for the guinea worm control program would have to be hired, trained, and provided transportation. Responsibilities of these workers migh also encompass other health areas than guinea worm control.

4. Costs

Total costs for this module, only 50 percent of which are considered "chargeable" to guinea worm control, are $69,316 for the two year program, or approximately $693 per village. Costs related to guinea worm control alone, therefore, are estimated at $34,658 or $347 per village.

C. Community water supply

1. Objectives

The objective of community water supply interventions is to provide protected and acceptable water free from infestation by the insect vector in a sufficient quantity to prevent the necessity of the population seeking drinking water from other, possibly contaminated, sources. This objective might be met by prioritizing existing drinking water programs in order to target guinea worm endemic areas first, or at least early, in the project.

2. Activities

Activities involved in implementing a community water supply strategy include:

(1) hydrogeologic surveys to identify usual sources of water, assess feasibility of different approaches, and develop a strategy and approach;

(2) new construction of tube wells and rehabilitation of existing tube wells where appropriate and feasible;

(3) dug well construction where appropriate and feasible; and

(4) capped springs and gravity systems where appropriate.

Each of these activities includes specification and estimates for the skilled and semi-skilled labor involved, as well as necessary equipment and materials.

Additionally, a critical element for all water supply interventions is provision for the involvement and training of the local villagers, with whom the final responsibility will remain regarding maintenance, upkeep, and the ultimate usefulness of the system.

3. Assumptions

A critical assumption regarding tube well construction or rehabilitation is that an adequate road system exists to move equipment and supplies. The fact that most guinea

worm endemic areas are remotely located indicates that this assumption may not be valid in parts of some countries. Other types of water supply interventions, or different intervention strategies entirely, may be the most feasible in some areas.

For the illustrative purposes of this paper, it was assumed that the possible community water supply intervention would comprise 35 percent new tube well construction, 10 percent tube well rehabilitation; 45 percent dug well construction; and 10 percent capped springs or gravity systems.

4. Costs

Total costs for a community water supply intervention, only 40 percent of which are considered "chargeable" to guinea worm control, are $605,619 for the two year program benefiting 100 villages, or approximately $6056 per village. Costs related to guinea worm control alone are estimated at $242,248 or $2422 per village.

Note that these costs represent a range of water supply approaches. In an actual country situation, probably no more than one or at most two approaches would be selected. The total costs per new tube well were estimated at approximately $9,500, assuming drilling equipment has to be purchased and the costs charged against the guinea worm control effort. If equipment exists and is usable in the country already, then costs could be expected to be substantially less. This has been the experience for the World Neighbors project in Togo.

D. Chemical treatment

1. Objectives

The use of chemical treatment would interrupt the cycle of guinea worm through the control or elimination of the cyclops water flea as a vector for the disease. The objective of this strategy is to establish an effective, ongoing system of treatment of water supplies to maintain them free from infestation with cyclops. This strategy would have to include consideration of multiple and temporary water sources, resistance to drinking water perhaps having a strange taste, and the efforts necessary to gain community involvement for the purchase, storage, and application of the control chemical.

There have been a number of studies that have examined different chemicals for the control of the vector. The chemical of choice from the studies that we looked at has consistently been temephos, commercially referred to as "Abate."

2. Activities

Activities related to the use of chemical treatment for guinea worm control include:

(1) conducting baseline surveys to identify drinking water sources and preparing application tables for the chemical;

(2) conducting village-level training for those who will be responsible;

(3) purchase and overseas transport of the temephos/abate;

(4) storage, repackaging, and local transport; and

(5) ongoing follow-up and support.

Abate comes in a variety of forms, including technical grade, a 50 percent emulsifiable concentrate, and one and two percent sand granule formulations. Costs, including transportation and storage, are estimated for both the emulsifiable concentrate and sand granule formulation. A variety of factors must be considered in choosing one form over another, including bulkiness, ease of application, effectiveness over time, and other factors.

3. Assumptions

For a chemical treatment strategy to be most effective, several conditions need to be present. First, there have to be consistent and reliable sources of still or slow moving water utilized by the population. The regular use of step-wells in Pakistan and India is an example of a usually appropriate location for chemical treatment for guinea worm vector control. Second, the population needs to be relatively settled rather than nomadic, and able to be organized for village-level purchasing, storage, and application at the right times and in the right amounts. Third, a reliable distribution and resupply system needs to exist from the national level down to the village level.

4. Costs

Costs related to chemical treatment alone for the two year program were calculated to be $33,570, or approximately $336 per village over the two years of the project. All of these costs, of course, are considered solely related to guinea worm control since few benefits meeting other development objectives would be expected to accrue.

[Figure 4 about here]

III. Programs and Total Costs

In order to estimate total program costs and conduct a cost-benefit analysis, the modules were put into two programmatically sensible groups:

(1) epidemiologic surveillance, community participation/ community health education, and community water supply; and

(2) epidemiologic surveillance, community participation/ community health education, and chemical treatment.

Estimated total costs for a two year community water supply program to benefit 100 villages and 50,000 people were approximately $690,000, or around $14 per capita. Estimated total costs related to guinea worm control alone were less than $300,000, or less than $6 per capita.

Estimated total costs for a two year chemical control program to benefit 100 villages and 50,000 people were approximately $121,000, or around $2.50 per capita. Estimated total costs related to guinea worm control were less than $87,000, or less than $2 per capita.

Costs for the chemical control program are less expensive than the CWS program in our two year example. However, other factors, such as the effectiveness of the intervention, the relative "permanence" of the intervention, availability of in-country resources, other health and development objectives, etc., must be taken into consideration in choosing one strategy over another.

IV. Cost Benefit Analysis [refer to Figure 4]

In combination with the costs estimated above for mounting an effective guinea worm control program, both production losses and costs of health care for guinea worm treatment were estimated.

We developed a microcomputer-based planning and cost-benefit model with parameters including, among a variety of others:

- disease prevalence in the total and working populations;
- working days lost per year;
- agricultural GDP;
- effectiveness of the particular intervention (CWS or chemical treatment) in preventing guinea worm disease;

- implementation factors to adjust for the phase-in effects of the intervention;

- effect of health care for guinea worm disease on productivity;

- costs of health care treatment and estimates of availability; and finally

- a discount rate allowing calculation of net present values.

Under our primary set of assumptions, production losses in agriculture per year due to guinea worm morbidity for the hypothetical 100 villages and 50,000 population were estimated at over $216,000. Further, assuming health care for guinea worm infections is available to 50 percent of the population, and the cost of treatment is $18 per case, health care costs related to guinea worm disease could amount to $315,000 per year for our group of affected villages. Since the availability and costs of health care are certainly questionable in many guinea worm-endemic countries, the cost-benefit models were estimated assuming both no health care available, as well as health care available to one-half the affected population.

[Figure 5 about here]

Benefit-to-cost ratios (BCRs) over a ten-year horizon were calculated, and were highly favorable, ranging from 2.47 to 3.65 under a variety of assumptions. The provision of health care alone for those affected by the disease was not found to be cost beneficial (i.e., had a BCR less than 1.00) under our assumptions.

Internal rates of return varied from 47 percent to 150 percent. Years-to-payback, indicating the number of years before the initial outlays and running costs become covered by the accumulating benefits, ranged from three to four years.

A sensitivity analysis was performed altering the discount rate and estimates of: disease prevalence; percent of population working; number of days in the agricultural season; and intervention effectiveness. BCRs greater than one were found even under our strictest and most conservative assumptions.

V. Conclusions

Guinea worm control can be accomplished directly through specifically focused programs, or indirectly, through modifications or add-ons to existing water and sanitation, primary health care, agriculture, or health education projects. Both direct and indirect approaches appear highly cost beneficial. As a disease with substantial economic and human cost, and as a disease which presents significant opportunities

for intervention, guinea worm control programs or adjuncts to programs offer high potential for low-cost, high-benefit, and highly visible results for the rural poor of afflicted areas in the world. Guinea worm control would also represent an important outcome for the ongoing International Drinking Water Supply and Sanitation Decade.

FIGURE 1

Cost-Effective Approaches to the Control of Dracunculiasis

"Modular" approach to controlling guinea worm disease

Purpose:

- To describe and develop cost estimates or cost guidelines for approaches to guinea worm control
- To encourage existing water supply and sanitation and primary health care projects to include cost-effective components to guinea worm control
- To increase awareness of benefits versus costs of guinea worm control and encourage programs where none currently exist

FIGURE 2

Guinea Worm Control "Modules" Examined

- Epidemiologic surveillance
- Community participation/community health education (including personal preventive measures)
- Community water supply
- Chemical control of vector

FIGURE 3

Steps:

- Detailed description and costing of different modules based on data from a variety of sources, specifying for each module:
  - — Objectives
  - — Activities
  - — Assumptions
  - — Cost items
- Assumptions regarding amounts "chargeable" solely to guinea worm control:

— Epidemiologic surveillance	100%
— Community participation	50%
— Community water supply	40%
— Chemical control	100%

FIGURE 4

Steps (continued)

- Putting together programmatically sensible grouping of activities:
  - — Epidemiologic surveillance/community participation/ *community water supply*
  - — Epidemiologic surveillance/community participation/ *chemical control*
- Estimating production losses due to guinea worm
- Estimating costs of health care for guinea worm
- Conducting cost-benefit analysis for different programmatic combinations

FIGURE 5

Resulting Benefit-Cost Ratios, Mid-Range Assumptions

Intervention	B/C Ratio	IRR
Community water supply, no health care available	2.47	47%
Chemical control, no health care available	3.42	114%
Community water supply, health care available	2.63	56%
Chemical control, health care available	3.65	150%
Health care alone	.74	—

73-508 (96)